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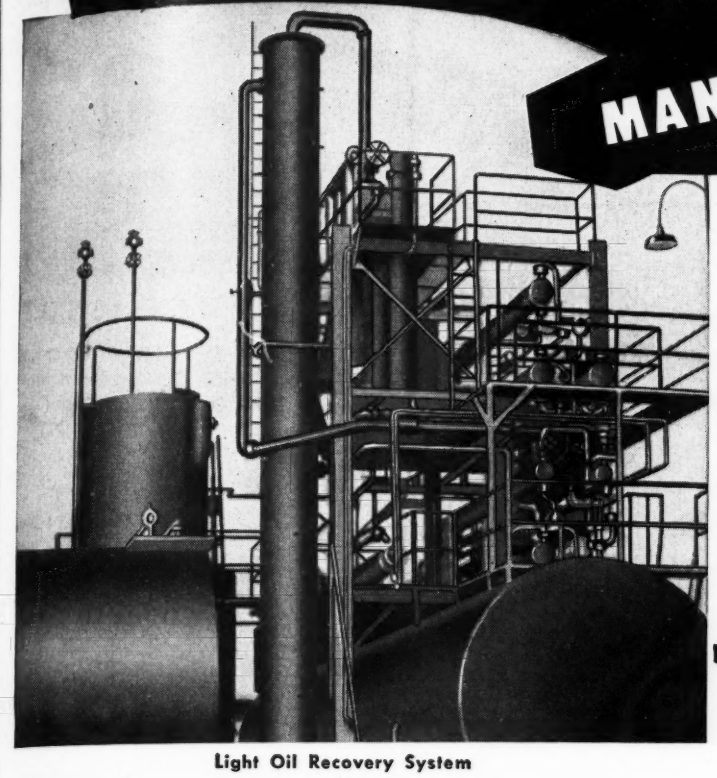

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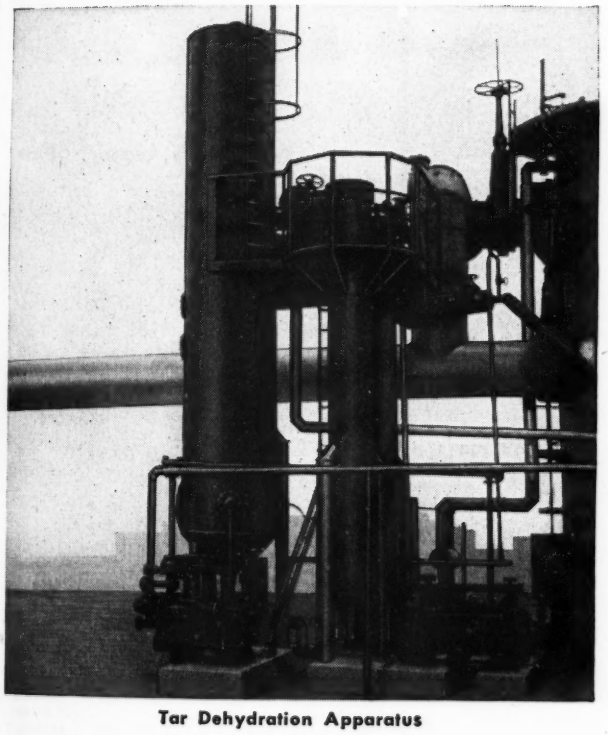

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CCA NBP

S. 1084 Hits Snag In House

Washington

THE SENATE, shortly before adjournment, passed S. 1084, sponsored originally by Sen. Herbert R. O'Conor (D.-Md.), which would relieve intrastate gas distributors from Federal Power Commission regulation, thus nullifying the majority decision of the Supreme Court in the famous East Ohio Gas Co. case.

However, the bill did not obtain action in the House of Representatives, owing principally (or so he claims in his publicity) to the "consumer watchdog," Rep. Robert Crosser (D.-O.), ailing, aged chairman of the House Committee on Interstate and Foreign Commerce. Since there was no companion measure in the House of Representatives, and it had not been considered by his committee, Representative Crosser insisted that the bill be "studied" by his committee. This was only a day before adjournment so nobody in his right mind expected Mr. Crosser to study the bill very much and report it out very fast, as, indeed, he didn't.

The bill, in fact, was reported unanimously by the full Senate Committee on Interstate Commerce. It had the approval of the FPC and the support of the National Association of Railroad and Utilities Commissioners. The vote for passage of the bill "on its merits" was 52 to 21. Sen. Paul Douglas (D.-Ill.) attempted to amend the bill to confine the exempting to gas distributors supplying a single metropolitan area, such as a company supplying only Chicago, but no other cities in Illinois, etc. The amendment failed, apparently with only Senators Humphrey (D.-Minn.) and Lehman (D.-N. Y.), whose hearts are bleeding constantly for consumers (as long as they're gas consumers), supporting it.

The bill passed in exactly the form it was reported from the Senate Committee on Interstate and Foreign Commerce. Senator Case (R.-S. Dak.), one of those who argued in favor of the bill when it was up for consideration, declared: "Enactment of this bill is required because there is a jurisdictional dispute between the state public utilities commissions and the Federal Power Commission. This bill is an effort to work out these differences."

Several Republicans voted against the measure. They are members of the so-called "liberal" bloc, meaning that they are Fair Dealers elected under the Republican banner. Included in this crew are Senators Tobey (N. H.), Aiken (Vt.), and Morse (Ore.).

No More OPS Intervention?

Washington

CONGRESS did business some favors during the final, hectic days of its second session, but none more welcome than slashing the funds made available to Office of Price Stabilization to pay employees.

Because of the OPS slashes, some 6000 to 8000 OPS employees in all parts of the nation have been given their walking papers. Another 4000 in Washington were to be let out. They include the employees of the OPS Transportation, Public Utilities and Fuels Division. Those who are not being discharged are being absorbed into other OPS divisions. The utilities branches will wither away. Functions are to be handled by other divisions. The obvious intent of Congress was to cut the agency's personnel to the bone so that there would not be any excuse for "thinking up" new jobs, such as was the specialty of employees in the utilities division.

Utilities, for all practical purposes, need not worry about OPS intervention, or "butting in," in the future.

The Buchanan Controversy

THOMAS C. BUCHANAN is still a member of the Federal Power Commission, but it took an interim appointment by the President to keep him there. His term expired June 22, and the Senate Commerce Committee, as predicted in *GAS* last month, failed to confirm him by a 9-to-4 vote. In doing so, the committee reversed the decision of a subcommittee which had reported favorably on the nomination.

The report of the subcommittee's hearings is a bulky thing, running 80 pages, but it makes interesting reading for those interested in the workings of such committees. More particularly, it shows the strong impact that the opinion molders of the Tom Stokes stripe have made upon the legislative mind.

The question before the house was a simple one in the mind of at least one member of the subcommittee, and the record shows that he had already made up his mind on how he would vote before testimony was even begun. To Senator Tobey, New Hampshire Republican, it was a simple matter of right vs wrong, of public interest vs moneyed interests, and the hearings were merely a formality. Mr. Buchanan was already "in," as far as he was con-

cerned. Witness . . .

When Senator Tobey asked the very first witness, Angus McDonald of the National Farmers Union, testifying in favor of the nomination, if he knew the source of opposition to the appointment and Mr. McDonald replied that he *believed* it emanated from private power companies, the senator said: "I think that is a safe statement—rather, an understatement." Further, when Mr. McDonald said he had nothing more to add to his favorable testimony, Senator Tobey, placing words in his mouth, persuaded him to say yes, he would "go so far as to say of this man, 'Give him the degree *summa cum laude*.'"

Then: "I go along with you in that," said the senator.

Later, with Mr. Buchanan on the stand, the senator asked: "Does your mind go back five years when you came before this committee . . . and a gentleman appeared in opposition, and asked some questions? Where did he come from? Pennsylvania? Whom had he seen and talked to down there? You mentioned two names. One is the head of the railroad industries and the other is the head of the utilities?"

Mr. Buchanan: "Yes, sir."

Senator Tobey: "That is the kind of man they send here as the masses' voice and to blah-blah-blah parrotlike. We have the powers of discernment. We can separate the wheat from the chaff. The same fellows are here today. They angered me very much, indeed. Utilities attempting to kill you off, having men seeking to regulate and control here."

Senators Magnuson of Washington and O'Conor of Maryland exhibited considerably more restraint in their handling of the inquiry, although Senator Magnuson did indicate some time before completion of the proceedings that he already intended to cast a favorable vote.

The overwhelming bulk of evidence presented in the hearings was unfavorable to Mr. Buchanan. William J. Murray of the Texas Railroad Commission appeared for his group in opposition to Mr. Buchanan's appointment, and his testimony was sound and fair. Warwick Downing, chairman of the Colorado oil and gas conservation commission, also testified, with considerably more firmness and somewhat less of an effort at objectivity than Mr. Murray exhibited. David Dunlap, a Harrisburg (Pa.) attorney, the "gentleman from Pennsylvania" referred to by Senator Tobey, also presented excellent arguments. His motives, incidentally, were questioned pointedly by the same senator, who used the "guilt by association" practice, currently being decried with extreme vigor by the "liberals" themselves when they find themselves the targets of loose charges of pro-Communism. Mr. Dunlap was being made to appear as a "tool" of the utilities simply on the basis that he talked with heads of two of them before testifying.

Space won't permit a thorough review of the report. But it does make interesting reading, if only as further evidence that the proponents of stricter federal control have drawn their own battle line on the ground of right against wrong, the people vs the "gougers." Honest differences of opinion over principles have no part in this battle: you're either for the people or you're a rat, and that's the way they'll keep on fighting it, like it or not.

Lost: A Quarter's Steel Supply

Washington

THE BIG STORY from Washington—because this has been the real center of the snafu—is the steel strike and its long-term ramifications, which will be regretted by many in the gas industry, as in other industries.

Petroleum Administration for Defense officials, in late July, were extremely pessimistic about the results of the steel strike in terms of new gas pipe-laying activities in the coming months, even though it was all over.

"We've lost at least 60 days of production, even if the mills start operating this afternon," one executive commented sourly. "I don't hesitate to say that this strike has wiped out what amounts to a full quarter's pipe-laying activities on all fronts in the coming months. Inventories of pipe on all projects have just about run dry now, and it will be a long time before the supplies are flowing well again."

A good rule-of-thumb on which to judge the loss of pipe is to take the amount used in the 12-month period from April 1951, to April 1952, and subtract from it a fourth of the total. That, as of Aug. 1, is how much pipe should be available in the period May 1952, through May 1953.

Timing's Bad

Washington

THE PICTURE as to appliance production, due to the steel strike, is only slightly less glum. In appliances, at least, there was originally some inventory which some manufacturers might have been glad to get worked off, but this had all taken place by July 15.

Now, it is feared, there will be a spate of necessary price increases all up and down the line in appliances, due both to wage rates that will reflect the increases won by the steel workers and to the increased cost of steel.

From the standpoint of appliance stores, distributors and manufacturers, the strike could not have come at a worse time. Consumer demand was just beginning to hit its 1951 stride again, due to the increased national income, when the steel strike shut off supplies. Now, there are plenty of customers, but for a long time there will be very little to sell to them.

technical trends

The Four Corners

Because of its proximity to the point where Arizona, Utah, Colorado, and New Mexico meet, the new San Juan Oil and Gas Basin has been named The Four Corners. Actually this field is in the extreme northwest corner of New Mexico with its northern tip projecting slightly into Colorado. Actually, also, it is not new as oil seepages were observed in early days and oil was definitely proven by shallow drilling in 1911. Furthermore, at least on the surface, it is an irregular high plateau rather than a basin.

Apart from extending major production further to the northwest of the mid-continent area, this field is interesting in its geographical aspects and its challenge to modern machinery and methods. It is at an elevation from 5000 to 7500 ft. The terrain is partially mountainous and very difficult to traverse. It covers 10,000 square miles, has poor roads and is sparsely settled. Winter temperatures go as low as 50° below zero. Many of the presently drilled wells cannot be reached during winter months because of deep snow and, therefore, have to be operated remotely.

Its earlier development was delayed by its inaccessibility and the inadequacy of former drilling equipment and techniques, but it is now proving up rapidly and becoming a significant producer of oil and gas. Four years ago, the total gas potential from this San Juan Basin was thought to be 4 trillion cu ft. Now the proven reserves are 4½ trillion cu ft and geological studies and wildcat discoveries make the ultimate recovery look more like 20 to 30 trillion cu ft, ranking as one of the large gas reserves of the United States. Gas so far has been delivered for use in New Mexico and Colorado by Southern Union Gas Co., and in New Mexico, Arizona, and California by El Paso Natural Gas Co.

Propane Storage Underground

In the November 1950 issue of this page an item headed "Salting Down Propane" described the preparation and use of underground cavities in salt beds, in which to store liquid propane. The cavities were formed by drilling to a suitable depth in the salt deposit and then pumping water down and then back out and thus dissolving the salt.

This practice has apparently been highly successful and more than 4 million barrels of LPG storage have been developed, and some interesting and ingenious operating details have been disclosed. For instance, if fresh water is used when the LPG is withdrawn by water displacement, the cavern or space is enlarged by solution of additional salt, and most storage has been progressively enlarged in this manner. If it is desired to preserve the roof of the cavern at its original elevation, the LPG is not completely expelled; and if no further enlargement of the cavern in any direction is desired, or if it is feared that further enlargement might penetrate beyond the salt deposit, saturated salt water can be used for displacement.

Underground LPG storage has also been created by excavating caverns in suitable rock formations. A typical operation was performed by Warren Petroleum in Stephens County, Texas, resulting in storage for 750,000 gal. of liquid. Following exploratory core drilling, a 4-ft shaft was sunk which passed through a limestone layer at 175 ft and was bottomed at another limestone layer at 223 ft. The shale between these two layers was removed by mining methods to create a cavern roughly in the shape of a flattened sphere 150 ft in diameter and 48 ft deep. The first filling and evacuation of LPG showed a loss of a little over 5%, and the second cycle about 2½%, and it is expected that subsequent loss will be negligible. The purity and color of the stored liquid was assertedly as good as taken from steel containers. There are, of course, many problems in selection and preparation of such storage, such as strength of the roof to avoid collapse or withstand the upward pressure, and impermeability to avoid loss and contamination of product. So far the developments have been confined to "tight" rock, as no practical and effective means has been developed to line permeable rock surfaces.

Catalytic Desmogger

A new unit, described in a recent issue of *Oil & Gas Journal* and called a "Catalytic Desmogger," is said to promote complete oxidation of combustible components of waste gases and thereby eliminate smoke, fumes, or other contamination and also develop usable heat that would otherwise not be recoverable. The first commercial application has been at a metal-coating plant which emitted fumes from baking ovens, and the results are reported as very satisfactory. The unit consists of an assembly of porcelain rods which are coated with a 0.003-in. thick film of alumina and platinum alloy, arranged to contact the gases as they pass up the stack.

This development is being carried forward by Oxy-Catalyst Manufacturing Co. Inc. of Wayne, Pa. It is expected to have application to a wide variety of industrial and commercial processes.

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Let's Help Cities Develop Sensible Street Usage Ordinances

By C. C. WESTMORELAND
Southern California Gas Co.
Los Angeles

PROTECTION of the public's interest through regulating the use of thoroughfares is a problem that has been with mankind for a long while. The Talmudic law, which had its origin about 2000 B.C., contains regulations indicating that the ancients wrestled with some of the problems still bothering us today.

For instance, one section said, "If one makes an opening in the public way, or makes an opening in the private domain of another, he is liable. If one digs a pit in a public way and an ox or an ass falls into it and is killed, he is liable." You will note that a differentiation was made between an "opening" and a "pit." This is an instance of a definition such as play such an important part in codes and ordinances today.

Legal "Pits"

The law specified that an "opening" became a "pit" when it was in excess of 10 handbreadths deep. This depth, approximately 3½ ft, was considered the minimum which would kill an animal if it fell into the hole. If an animal fell into a "pit" and was killed, the excavator was responsible for the death of the animal. If the animal was killed as a result from a fall in a shallower excavation, presumably it was the animal's fault, not the excavator's.

Another regulation prohibited placing stones that had been removed from private property on a public thoroughfare. An interesting story on this subject is contained in early Jewish religious literature. A man who was removing rocks from his field and depositing them in the thoroughfare was asked, "Why do you remove stones from property that is not yours and put them on land that is yours?" This question did not make sense to him until one dark night when, after a turn of fortune had deprived him of his land, he stumbled and was injured on the rocks he had deposited in the road.

The moral of this story is, of course, that all of us have an equity in the public domain that is more lasting than equity we hold in private property. An interest in the public domain and public welfare is the business of us all. This is particularly true of the utility company, whose prosperity is so directly affected by the community's welfare and economic stability.

In addition to protecting our property entrusted to city officials, proper regulations are necessary to assure utilities of equitable treatment under the law in our use of the streets as a means of distributing our product. Inadequate regulations allow abuses which in turn give rise to the enactment of corrective laws, passed in a heat of public indignation, that are directed at unethical practices of a few, but apply to both the guilty and the innocent. The best defense against such vindictive legislation is adequate regulation and proper enforcement. More attention is usually directed to the localities where considerable legislation has been passed; but, actually in the long run the excavator is more vulnerable in localities where little or no regulation exists.

Granting, then, that it is to the advantage of the ethical excavator to support regulations regarding street usage, let's look at the problem confronting a company, such as a utility, who has occasion to make excavations over a wide area. This is not intended as criticism but simply as a means of a utility's predicament in complying with regulations when cities in which it operates lack uniform requirements.

Light Spacing

Requirements regarding the spacing of lights is one point that we might reasonably expect to be fairly uniform among jurisdictions. Variations within a given jurisdiction, depending upon traffic conditions, street usage, etc., would be understandable because the number of lights required to adequately protect an open ditch could, logically, vary depending upon the speed and congestion of traffic. However, upon investigating the subject, we find that the variations on this point are based on jurisdictional boundaries rather than traffic conditions. *Table 1* shows what is required by ordinance in 70 southern California cities.

In 21 cases lights are not even required,

TABLE 1. Spacing Requirements for Lights on Excavations
(70 southern California communities)

Spacing	Number of Cities	Percent
Not less than 25 ft	2	3
Not less than 50 ft	22	31
Not less than 100 ft	9	13
Required but not fixed	16	23
Not required by ordinance	21	30

Presented at the PCGA distribution conference in Los Angeles in April.

but obviously excavations should be lighted at night. Sixteen cities require lights but do not fix the spacing, leaving this to the discretion of the excavator and/or the individual inspector. The remainder vary between 25 and 100 ft. Obviously, this range is too great for all of these ordinances to be correct. Technical violation of the requirements for spacing lights may seem minor, but if an accident occurs involving the excavation and action for damage results, the violation of the law may handicap the defense.

Regulating Barriers

Barriers fall in the same category as lights. Thirty-five of the cities have ordinances regulating barriers, some of which fix spacing, marking, and size. If the excavator observed the letter of the law it would be necessary to carry special barriers to conform with requirements of individual cities. Obviously a statewide uniform ordinance is desirable for both cities and counties, to simplify compliance with the law where utilities and contractors have occasion to work in incorporated cities, many of which have common boundaries or are so closely situated that a single operator has occasion to work in a number of jurisdictions.

In the matter of excavating permits we also find a regrettable lack of uniformity. (See *Table 2*)

In 32% of the cities studied, no permit is required for excavating in streets. It is in these localities that we are most vulnerable to over-restrictive legislation, because this arrangement leads to the abuses mentioned earlier. Sixty-eight per cent of the cities require permits to excavate in the streets. Only 10, or 13%, of these provide for excavations to be made in case of emergencies before obtaining a permit. In 15 of the 41 cities that do not contain positive provision for emergency conditions, allowance is made for excavating without a permit in cases where emergencies arise during days when the city offices are not open. In other words, it would be legal to handle an emergency situation immediately if it occurred on a Sunday or a holiday, but it would be illegal to make the same excavation without first obtaining the permit if the incident occurred during a regularly scheduled working day or during the night of any scheduled working day. If a utility ever delayed the handling of an emergency situation, and offered this as an excuse, it would certainly be embarrassing to all concerned.

This situation is, of course, usually covered by a "gentlemen's agreement" between the governing body and the utility, and authorities have not objected where a utility proceeds to excavate under circumstances of necessity. Such informal agreements, however, do not protect the utility when it excavates without a permit if an accident involving personal injury or property damage occurs. With the expanding street surface traffic, the responsibility is great and the legal hazard of continuously violating the law is increasing. The fact that it is mutually recognized that action must be taken in emergencies indicates that ordinances should make provision for these situations.

Cover Requirements

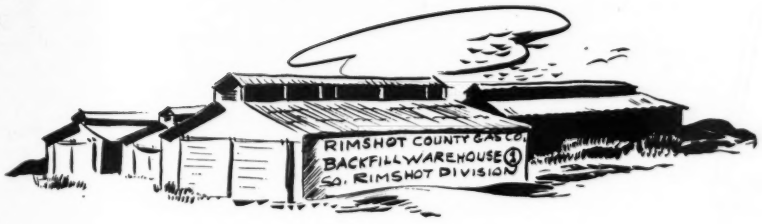
Many of the cities covered in *Table 3*, which lists the minimum cover requirements for pipelines, are closely situated one to the other and a number of them have common boundaries. The minority that have specific minimum requirements are not in agreement. The variation that exists causes confusion and too frequently probably results in failure to comply with ordinance requirements. In such cases, the owner of the structure is responsible for consequences if the structure is damaged or causes damage to others.

This was positively demonstrated in a judgment for $20,000 rendered against our company when this point was involved. Where large diameter pipe or deep, double-duct structures are laid at minimum cover they present a problem in over-crossing them with service laterals. Provision should be made to allow structures to cross over other structures at less than minimum coverage to reduce the interference problem that occurs at street intersections and on service laterals.

The subject of backfill compaction is covered in such a variety of ways in city and county ordinances that only the major points of difference are included in *Table 4*. There are numerous other variations not listed, involving such things as the weight of the roller and the depth of layers of soil returned to the ditch between tamping or flooding operations.

In fact, we don't even have uniform agreement on who should do the work. In three cases the city prefers to do the backfilling and the resurfacing. A few of the 49 cities included in the first group contain very general statements on this subject, but most of them are completely devoid of any reference to backfilling procedures or requirements. We might expect to see this degree of variation existing in a single city where a wide variety of soil conditions exist within its boundaries. It is quite possible that all of the methods specified here would be practical depending upon the compaction characteristics of the soil. In too many cases, however, the variations depend upon municipal boundaries rather than soil boundaries.

While the items that have been discussed are these that show the greatest degree of variation between the jurisdictions studied, nevertheless they truly indicate the problem facing the utility in attempting to observe municipal regulations. We must observe such regula-



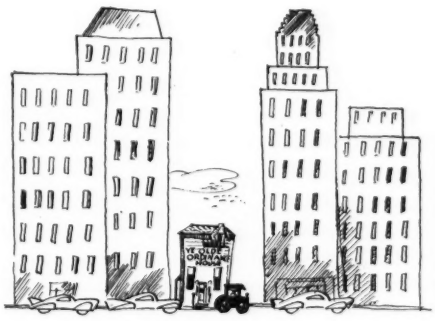
tions. We cannot afford to ignore requirements, taking the view that we are faced with an impossible situation and excusing our actions on the basis that the law is not being enforced. Ignorance of the law is no defense for violation and exposure to legal action is increasing as street usage and traffic problems increase.

This lack of consistence is not entirely the fault of public officials. They have their problems in getting revised ordinances through their respective councils, and that problem is complicated unless proposed changes have at least reasonable acceptance from both the general public and those being regulated. Excavators, in general, have not made sufficient effort to crystallize their viewpoints and give public officials adequate support in establishing reasonable and practical ordinances. As a result, nothing has been done and many of the ordinances are badly out of date.

Street Ordinances

You may be interested to know that of the 78 jurisdictions studied only 54 had any well defined street ordinances. The street ordinances that do exist break down according to age as shown in *Table 5*. Expressed another way, over a third of the ordinances were new when the Model "T" was a modern means of transportation. Although some of these old ordinances have been amended, most of them are as outmoded as the Model "T."

If these conditions are to be remedied, we, as excavators, must accept our share of the responsibility in actively supporting groups working towards uniform ordinances. Very little has been done in this respect, but encouraging indications along this line have come from the East Bay (San Francisco) chapter of the American Public Works Assn. These courageous men, who made a real effort to remedy this chaotic condition, deserve a great deal of credit. The diversity of opinions on this subject made it inevitable that the results of their efforts would be subject to controversy, if not criticism. Although we do not agree with the gentlemen from the north in some of the details contained in their ordinance, we are certainly with them 100% in principle.



Perhaps we may live to see a time when street ordinances will be uniform to the degree that presently exists in building ordinances. We cannot expect this to happen, however, without participation of the excavators. It is certainly worthy of our support. We have a duty to our customers to operate economically and keep our rates at the lowest practical level. We cannot adopt efficient, standardized procedures or make full use of labor-saving, specialized equipment if the rules under which we operate change when one of our trucks moves from one location to another.

Regulations' Burden

The public official, on the other hand, should remember that our customer is also his taxpayer, and regulations that result in wasted manpower and needless cost are a burden to the whole community. We have put a lot of pipe in the ground and dug up a lot of streets, we have patched a lot of streets, and we have even re-patched a lot of streets either because we did not do it right in the first place or because the city was too slow in making permit repairs depending on the point of view.

From all of this exposure we certainly should have accumulated some knowledge on the subject. Let's make that experience available to public officials and join with them in correcting this condition.

TABLE 2. Excavating Permits
(74 southern California cities)

	Number of Cities	Percent
A. Permit not required	23	32
B. Permit required before excavating	41	55
C. Excavating allowed without first obtaining permit in emergency	10	13

TABLE 3. Depth of Cover

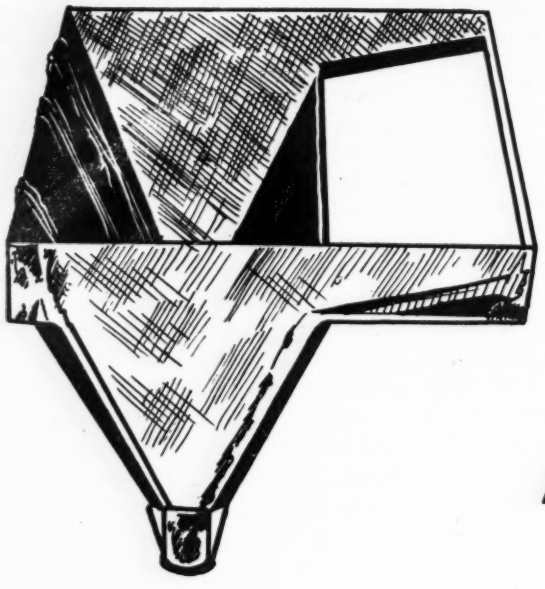
Depth Required	Number of Cities	Percent
12 in.	1	1½
18 in.	2	3
24 in.	14	20
30 in.	7	10
36 in.	1	1½
Not established by ordinance	19	27
No excavating ordinance	26	37

TABLE 4. Backfill Compaction
(78 southern California cities and counties)

	Number of Cities	Percent
No backfill requirements in ordinance	49	63
City backfills and resurfaces	3	4
Requires rolling and flooding or tamping	7	9
Requires flooding or tamping	10	13
Requires only flooding	5	6
Requires only tamping	4	5

TABLE 5. Age of Street Ordinances

	Number of Cities	Percent
1 to 15 years	20	37
16 to 30 years	15	28
Over 30 years old	19	35



Research again proves superiority of gas in cooking

THE AGA DESIGNS A HEAVY-DUTY FRYER

By R. L. STONE
AGA Laboratories
Cleveland

OUR aim was to design and build a heavy-duty gas fryer that could compete with the electric fryers which until now have had nearly a monopoly in the field. The research project we have just finished at the AGA laboratories has not only reached this goal but may even have exceeded it.

The project is now in its final stage, that of publicizing our findings so that manufacturers may build and market the fryer we have developed or improve their own fryers.

"A heavy-duty fryer," by our definition, is one which is capable of continuously frying heavy loads of food to completion in the minimum length of time. It should also fry a maximum of food in the minimum weight of fat.

To build this heavy-duty fryer, we went back to the beginning. We studied the characteristics of frying fats and oils, and wrote to every fat manufacturer for technical information. We watched the circulation of fat in experimental fryers, and tested fats under simulated frying conditions to find out how and why they deteriorated. We studied the heat required by different types of food, particularly potatoes. The shapes and sizes of kettles and the positions of heated surfaces were investigated. Finally, we studied the over-all frying process with its interrelation between weights of fat and food, and efficiency of heat application. We developed a great deal of new and useful information on fats, foods, and fryers.

Frying food is a more complicated

What lifts the project reported in this article above the narrow limits of the ordinary research project is more than its inherent value as a solution to a gas utilization problem. It points the way to the compression of the "notorious 10-year lapse between the release of a research bulletin and the initial stage of marketing" into a period of months.

Recent public utterances of industry leaders, such as the above quote from Keynoter Leon Ourusoff of Washington at the recent AGA research and utilization conference, attest to the growing concern over this time lag. H. Carl Wolf of the AGA, in a paper prepared for the same meeting, termed the time lag the *big* problem in the field of research.

The lag exists not only in the field of gas utilization equipment but in operating tools as well. As Guy Corfield remarked in his "Technical Trends" page in July *GAS* (speaking of plastic tubing for gas service piping), the confinement of investigative procedure to a relatively few types of material and of practical use to only one, and the "only passive" interest of most companies "would seem to create a situation where basic association research is indicated, together with field trials . . ." The editors of *GAS* have long felt that fuller association participation in the development of new equipment is needed, not so much as a service to the manufacturers but as a service to the utility industry itself. Many small manufacturers may not be able to survive the "10-year lapse." Moreover, the utility industry is not being fair to itself if it does not take every advantage of new developments by proving them quickly and adopting them as soon as they are proved.

Scattered examples of how association research has quickened the process of development and application are the Hall high-Btu process and the current field trials on automatic oven ignition (the latter, unfortunately, having been stretched out somewhat longer than originally intended). The heavy-duty fryer project, however, would appear to be the shining example of how the AGA can move through the successive stages of research and implementation with a minimum of ritual and a maximum of speed.

The inception of the program was certainly not auspicious. Events which culminated in the publication by the AGA Laboratories in 1944 of bulletin 24 on "Immersion Tubes," illustrating many of the factors in fryer design, had unfolded in the usual way. An immersion tube fryer developed in the bulletin was never marketed, nor was a power burner fryer built by a manufacturer based on information contained in the bulletin.

Thus a practical commercial heavy-duty fryer was still needed to compete with electric models. Investigations by the AGA committee on competitive services emphasized the importance of a faster, more effective heavy-duty fryer. In 1949, as a PAR plan activity, the committee on industrial and commercial gas research assigned the job of developing such a fryer to the laboratories. Within two years, the lab had evaluated all major factors of design and, most important of all, correlated them by building an experimental demonstration unit.

This prototype was shown to manufacturers a year ago—Aug. 2—at a seminar held at the lab. The fryer was of a design that was a total departure from anything that had ever been produced. The manufacturers liked what they saw, and as of June 1, three of them had submitted their own models to the lab for experimental check tests.

Bulletin 66, "Design Studies of Deep Fat Fryers," details the study and provides a handbook for manufacturers for use in designing their own fryers. This article, adapted from a talk made before the Commercial Gas School in May and again before a New England Gas Assn. meeting June 13, covers much of the ground that was covered in the bulletin.

operation than heating-up. To analyze frying, we resorted to the point of view that the fat was an "intermediate heat transfer fluid." The process is as follows: The gas burns and heats the kettle (or its immersion tubes); the heat is conducted through the wall; the wall facing the fat heats the fat; and finally, the fat circulates around carrying the heat to the food.

In any one frying operation, for a single basket load of food, we have what might be called a frying cycle. This cycle is the time required for frying a load plus the time required to recover to original temperature. See *Fig. 1.*

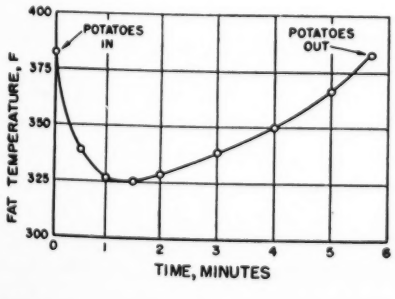
Frying Cycle

Fat temperature decreases in the first part of the cycle because the food takes heat away from the fat faster than the burner can supply it. When the temperature begins to rise, it means that the burner is putting heat back faster than the food absorbs it. For the whole cycle, there is thus no loss or gain of heat for the fat, and we can assume that nearly all the heat received by the fat from the burner has gone into the food.

The fat temperature drop indicated is characteristic of all heavy-duty frying, regardless of fuel. From the rate of fat temperature drop it is possible to estimate how fast the food is taking heat. To overcome the initial temperature drop by adding sufficient heat and then tapering off is an impractical method of fryer design, and is not done for any type of food. It is better to utilize the "flywheel effect," as is currently done with continuous steady heat input.

Besides analyzing fat temperatures, we computed the heat requirement to fry the potatoes. If cold, wet potatoes are immersed in fat, the first thing that happens is that surface water is turned to steam and additional water continues to boil off as frying continues. This permits us to analyze the potato frying process in three steps: First, the potato is heated to the boiling point of water; second, the water is converted to steam; and third, the steam is superheated to the average fat temperature. The difference in weight of potatoes before and after frying, with suitable correction for fat absorption, can be used to estimate how much heat was removed from the fat to fry the potatoes. Thus, it takes from 550 to 650 Btu per pound of raw weight to fry potatoes.

Fig. 1. Fat temperatures during frying.



As expected, both speed of frying and the temperature drop of the fat are dependent on the fat-to-food ratio, and also on the heat input.

It is fairly difficult to prepare graphs for predicting how long it takes to fry various foods. However, the use of some heat balances, which are a way of expressing the principle of conservation of energy, permitted the development of a really useful graphical tool. This tool is a nomograph, or alignment chart, which we call the "Frying Performance Nomograph," *Fig. 2.* This nomograph contains all the factors pertinent to the frying of any food, in fryers of any size, with any source of heat energy.

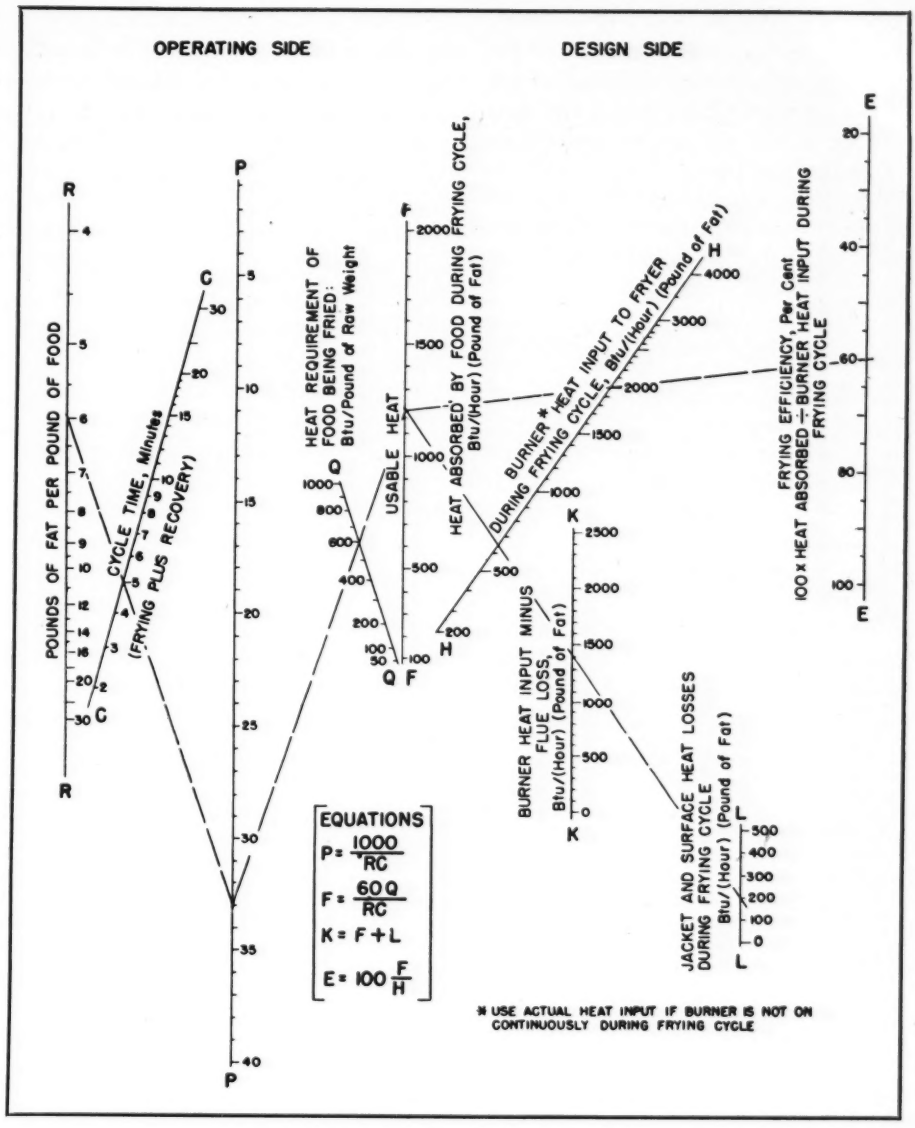

OPERATING SIDE
DESIGN SIDE
POUNDS OF FAT PER POUND OF FOOD
CYCLE TIME, Minutes (FRYING PLUS RECOVERY)
HEAT REQUIREMENT OF FOOD BEING FRIED: Btu/Pound of Raw Weight
USABLE HEAT
HEAT ABSORBED BY FOOD DURING FRYING CYCLE, Btu/(Hour) (Pound of Fat)
BURNER * HEAT INPUT TO FRYER DURING FRYING CYCLE, Btu/(Hour) (Pound of Fat)
FRYING EFFICIENCY, Per Cent 100 x HEAT ABSORBED ÷ BURNER HEAT INPUT DURING FRYING CYCLE
BURNER HEAT INPUT MINUS FLUE LOSS, Btu/(Hour) (Pound of Fat)
JACKET AND SURFACE HEAT LOSSES DURING FRYING CYCLE Btu/(Hour) (Pound of Fat)
EQUATIONS
P = 1000/RC
F = 60Q/RC
K = F + L
E = 100 F/H
* USE ACTUAL HEAT INPUT IF BURNER IS NOT ON CONTINUOUSLY DURING FRYING CYCLE

Fig. 2. Frying performance nomograph.

The Nomograph

One condition of its use is indicated by the dashed lines, which represent a hypothetical fryer. Suppose we wish to build a fryer which will fry 1 lb of potatoes in 6 lbs of fat to completion in 5 minutes cycle time. We connect these two points on the R and C scales with a dashed line projected over to the P scale. Because we are frying potatoes which take 600 Btu per pound, the value of Q is 600. Connecting the P and Q scales with a second dashed line intersecting the F scale, it can be seen that we have determined a number of 1200 Btu per pound of fat as "Usable Heat." The

hourly potato production will be 1200/600, or 2 lbs for every pound of fat. Because these calculations are based on 1 lb of fat, the total production of any fryer may be found simply by multiplying production per pound of fat by total fat weight. For a food requiring only 200 Btu per raw pound, the hourly food production will be 1200/200, or 6 lbs per hour per pound of fat in the fryer.

Usable Heat Concept

This concept of usable heat is the key to the performance of any fryer. It is the amount of heat in the fat ready and available to fry food. It is less than the total amount because part of the heat supplied must be used to keep the fat up to temperature. For example, the line from the F scale through the K and L scales shows that if heat losses during frying are 200 Btu per hour per pound of fat, the total amount of heat which must be extracted from the combustion

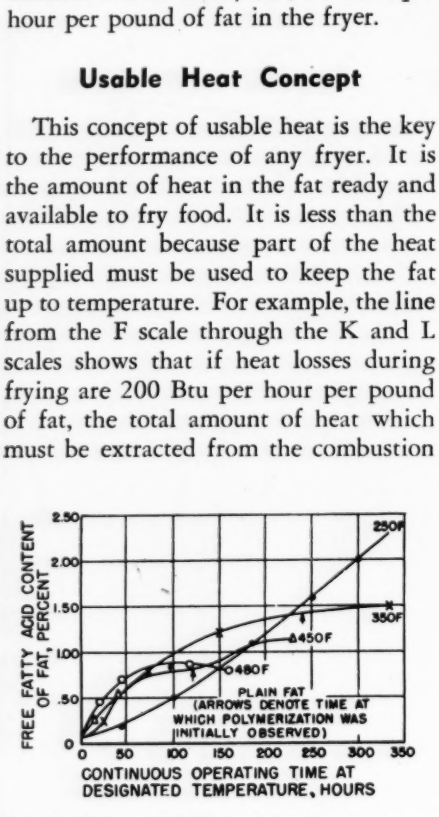


Fig. 3. Effect of different temperatures on fat deterioration.

gases is 1400 Btu per hour per pound.

If we are shooting for a frying efficiency of 60%, the line through the F, H, and E scales shows that we must do the job on a burner heat input of 2000 Btu per hour per pound of fat.

The lines on *Fig. 2* actually represent the design conditions we chose for our heavy-duty gas fryer. They all combine to give a high food output per pound of fat and to reduce fat costs. Frying and recovery will both be rapid, and a high food output per fryer will be obtained. Also, and possibly most important of all, *the frying performance will be every bit as good as the highest powered electric fryer now made,* such as the 10 kw Hotpoint containing 25 lbs of fat.

While this investigation of fryer performance was extremely valuable to us, it did not reveal why the design of gas fryers had not kept up with the competition. We had to ask the question: What limits the performance of gas fryers? and then find our own answers.

We started this process with an investigation of how hot fats could be heated, and how fast they deteriorated due to heat, stirring, crumbs, and cooking.

We investigated two chemical methods of determining when fat has deteriorated to the point where it has to be discarded. These methods were rancidity and the free fatty acid content of the fat. Measuring fatty acid content was a simple and well standardized procedure, but rancidity proved to be very elusive indeed. There are no adequate definitions for rancidity of a hydrogenerated vegetable fat, as it is likely to occur under frying conditions. Under simulated frying fat breakdown tests, no unpleasant smell developed even in fat that was a viscous brown mass about the consistency of axle grease. Fat which had been heated for a relatively long time left a waxy, orange-colored layer on potatoes, but did not impart any unusual flavor. We were able to obtain some extremely acrid vapors by destructive distillation of fat at a temperature of over 600° in a closed flask. Under frying conditions, however, the amount of such vapor formed is very small, and can occur whether the fat is fresh or old.

Our simulated frying tests consisted of heating four fat samples at once in open beakers in a constant temperature bath. The bath was held at temperatures of 250°, 350°, 450°, and 480° F. A different type of test condition was tried on each of the four fat samples. One was plain, one was heated with crumbs, the third had crumbs plus stirring, and the fourth had a small amount of steam continuously bubbled through the fat. Crumbs and stirring did not cause fatty acid to accumulate any faster than in the plain sample. Also, the fatty acid concentration tended to level out at a constant percentage. This we believe indicates that some other chemical reaction in the fat is using up the fatty acid as fast as it forms. While some authorities indicated that accumulation of fatty acids caused the fat to break down faster, we could not draw this same conclusion.

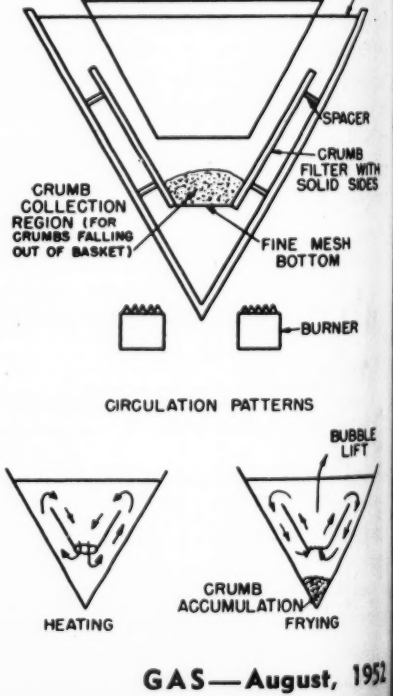
Steam was the cause of very rapid fat breakdown due to the chemical reaction between water and fat. This indicates that heavy-duty cooking itself may be the most serious cause of fat breakdown, due mainly to the release of large quantities of water and steam from the food into the fat. We were unable, however, to establish any mathematical relationship between fat deterioration under the steam test, and that due to actual cooking.

Another interesting effect of different temperatures on plain fat is shown in *Fig. 3.* One might think that the higher the fat temperature, the greater the deterioration. But this chart shows that the 480° F sample had the lowest percentage of acid. Apparently, at this higher temperature there must be a second chemical reaction which uses up the fatty acid faster than at lower temperature. For example, although the final free fatty acid in the 480° F sample was low, the final state of the sample was a brown, gooey mass with a thick, rubbery film on top.

Wall Temperature

None of these tests was of direct value in finding the maximum temperature of kettle wall to which fat could be exposed. A test was finally devised which gave conclusive results. A small container was built, in which a hot spot 2 in. square was maintained at 650° F while the main body of fat was held at 400° F. Under these conditions, only those molecules of fat directly in contact with the hot spot were heated to 650° F, and they were immediately cooled upon being swept away in a current of circulating fat. The rate of free fatty acid accumulation was 1/375 of that obtained when the entire fat sample was heated to 650° F in a closed flask. On the basis of these tests, we concluded that maximum kettle wall temperatures in the range of 650° to 700° F could be used without causing excessive fat deterioration rates.

Fig. 4. Fat circulation effects in hypothetical V-shaped fryer.



The permissible use of higher kettle surface temperatures removed an important limitation on gas fryer performance. Previously, the limit was 535° F, or a 135° F rise above 400° F maximum fat temperature. Now, a rise as high as 300° F became permissible. The advantage of higher surface temperature is that as the heat throughput increases so does the temperature difference between the wall and the fat. Because one of the major deficiencies of gas fryers in the past was due to an inability to pump enough heat into the fat, this knowledge opened the way to other improvements in gas fryer design.

The next problem we faced was that of designing kettle surfaces which would extract more heat from the burning gas. Tests of radiant combustion chambers and flue passage liners showed that these expedients did not materially improve heat transfer. We found that the amount of heat we could extract per square foot of flat surface never exceeded 13,600 Btu per hour for some experimental V-shaped kettles, and that in practice the limit appeared to be around 10,000 Btu per hour per square foot.

These limits pointed directly to the use of extended surfaces or fins to increase the effective area on the gas side of a fryer kettle. There are some other factors which must be considered, but in general, fins have proved to be a highly satisfactory solution to the problem of improved heat utilization or efficiency.

The electric fryer is not governed by any limits on heat input. Any wattage of heating element may be immersed in the fat. One electric fryer has 18 kw of energy transferred through 2.5 sq ft of tubular heating elements. This is 7.2 kw per square foot. It can be seen that element temperatures as high as 680° F (400° F + 280° F) may result. Thus, electric fryers may suffer from greater fat deterioration than a gas fryer due to the fact that the entire heated surface can reach a high temperature.

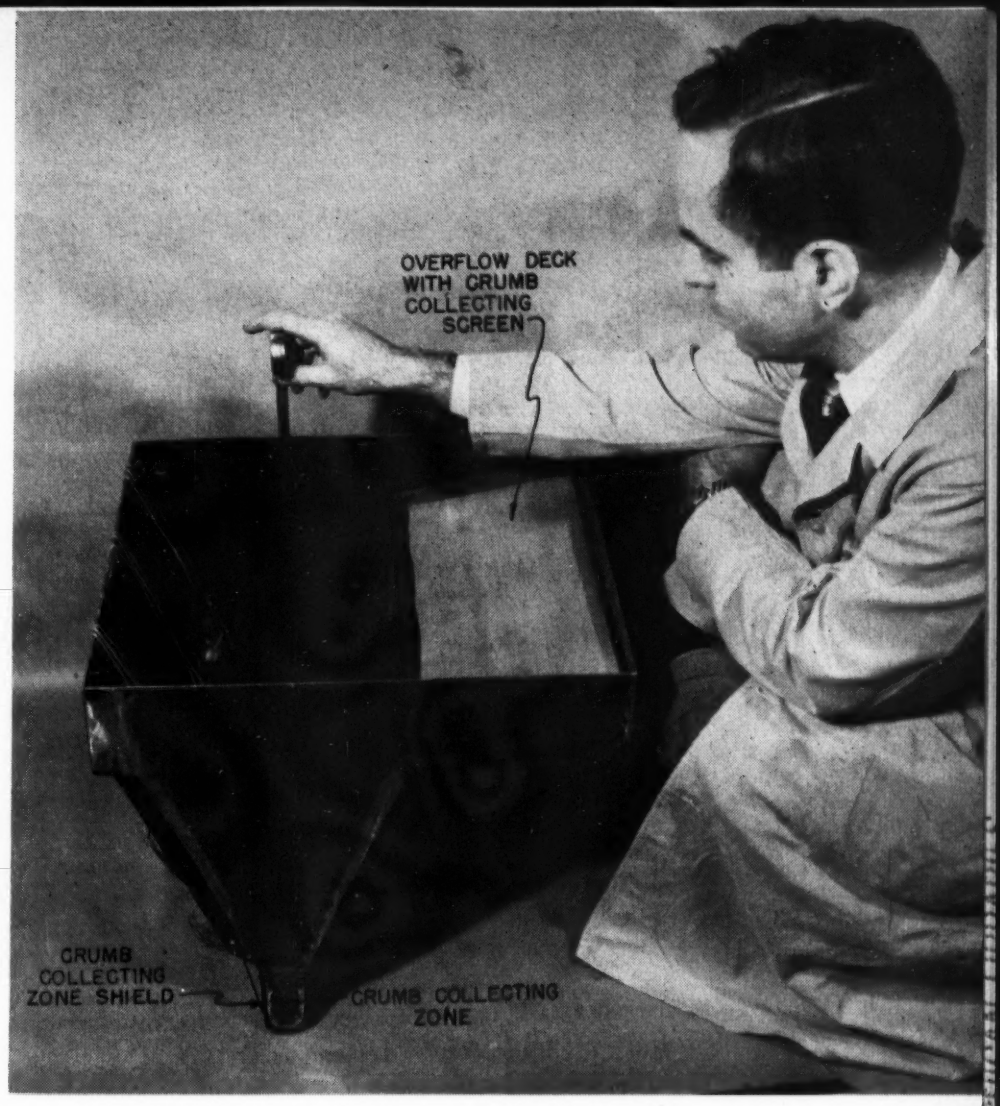


Fig. 5. The fryer kettle showing crumb screen and sloped walls.

Applying the Theory

The next question is: what are the practical considerations in fryer design, and how does this theory fit in?

Perhaps the first item to be considered in developing our heavy-duty fryer was the so-called "cold zone," which functions to remove crumbs from the fat. The presence of crumbs in fat does not cause accelerated fat deterioration, but crumbs which come to rest on a heated surface may char and then redeposit as little black specks on the food. Thus it is still necessary to remove crumbs, although not necessarily by a cold zone. A cold zone has other disadvantages. It forces the fryer owner to use more fat than he needs to fry the food. It mixes with hot fat during frying to lower the fat temperature and increase frying time. Furthermore, it is often inaccessible and difficult to clean.

To replace the cold zone, we considered the use of a settling or sedimentation zone into which the crumbs might fall, but which contained only a small volume of fat without special provisions to keep it cold. This settling zone may be augmented by other methods for screening or filtering out the crumbs.

There are several natural aids for the removal of crumbs from the fat in a fryer which have not as yet been fully exploited. Everyone has observed how violently fat bubbles when a loaded food basket is immersed. This bubbling is accompanied by a strong circulation of fat in the fryer, as well as a rise in fat level. This fat circulation may be in the same direction as that during heating-up, or it may be different. Suppose that we have a V-shaped fryer constructed like the one in *Fig. 4*. When this fryer is heated, the fat will rise in the space between the kettle wall and the crumb filter. When a load of food is placed in the fat inside the filter, the fat circulation is in the opposite direction, as shown in the lower right hand diagram. Thus, any crumbs previously caught on the filter screen will be swept up and out and deposited on the heated wall of the fryer. While there are ways of locating submerged screens to avoid the bad effects of this circulation reversal, we used the fat level rise principle to remove crumbs in the AGA fryer.

Crumb Removal

The fat level rise method uses the entrainment of crumbs in the bubbling circulation fat to remove them from the food and carry them onto a screen on top of the splash deck. This screen functions only when food is frying. Loose crumbs are lifted out of the basket and carried along by the violently agitated mixture

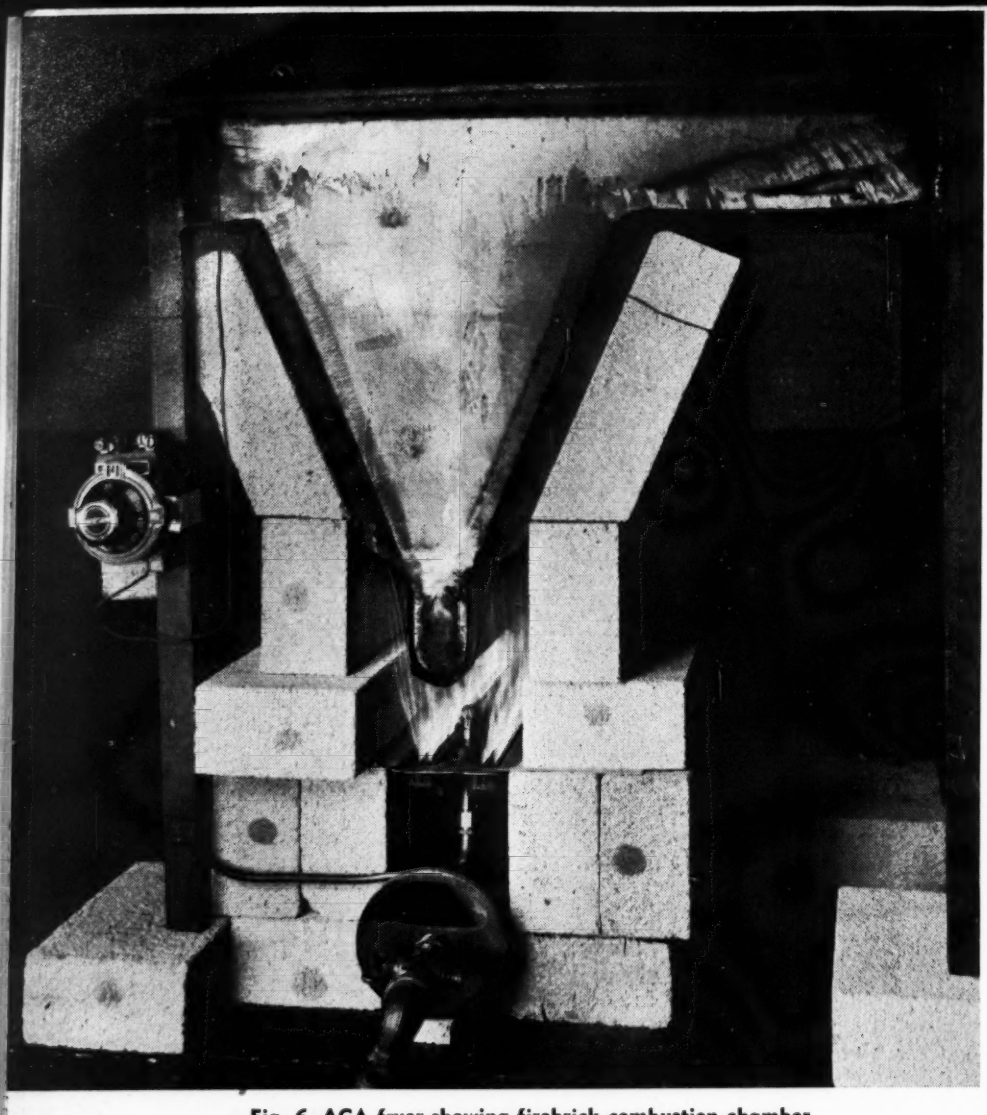


Fig. 6. AGA fryer showing firebrick combustion chamber.

over the splash deck. Those crumbs which are not deposited the first time can circulate until they either get caught or sink into the settling zone below the frying level. Deposits of crumbs on the screen can be removed at any time without disturbing normal frying procedures. The only precaution to observe is to make sure that the fat level is properly maintained.

The photograph of the kettle of this fryer *Fig. 5* shows its external, above-fat-level screen, located on top of the splash deck. So far as we can tell, this screen collects the crumbs from potatoes, and separates small pieces from the circulating fat. We believe it should also be satisfactory for breaded foods, if correctly designed and located.

From this photograph of the AGA fryer kettle, you will be able to see how the inside walls are sloped so that food particles won't deposit or pile up on the heated surface. They are smooth, flat, and entirely accessible for hand cleaning. The only expensive operation in building this fryer is the welding of the fins which must be done correctly to prevent warping and insure good heat transfer.

Fig. 6 shows how we built the kettle into a prototype fryer. One of the features of this fryer was a firebrick combustion box. This box allowed us to lower the burner until there was no danger of flame impingement on the kettle and still keep a high heat transfer efficiency. Introducing air in the center of the burner caused the flame to burn along the bricks and thus avoid direct heating of the shielded settling zone.

Exceeds Expectations

This fryer readily exceeded our design performance figures. It was designed to hold 32 lbs of fat and to have a heat input up to 70,000 Btu per hour, with a frying efficiency of 60% or more. In one bench test, we obtained a usable heat value of 1500 Btu per pound of fat which can be translated into about 77 lbs of potatoes produced per hour in single-step frying. Probably this high performance cannot be obtained during ordinary commercial operation, but potato outputs of 70 lbs per hour should be readily attainable. The capacity of this fryer to brown potatoes in the final step of two-step frying may be as high as 300 lbs per hour, or enough portions to serve 600 persons per hour. Allowing a minute and a half to brown each load, the load would be 7½ lbs, or nearly as much as a full size basket for this fryer will hold.

The preheating speed of this fryer at 70,000 Btu per hour heat input is about 28° per minute. For a 300° rise, this comes to a little over 10 minutes, at which time all the fat will be melted and the fryer will be ready to fry. This speed of heating is equal to or better than that observed for some contemporary electric fryers.

I should like to stress that the V-shaped kettle developed by the AGA is only one of a number of possible kettle shapes. Our method of designing fryers applies to immersion tubes and to many other possible kettle forms, including different angles of V, curved sides, cones, pyramids, and so forth. To achieve a good heavy-duty fryer design requires only that each of these fryers conforms to the proper balance of heat input, heat transfer surface area, and fat weight.

The AGA fryer is not the only heavy-duty gas fryer in existence. A California gas company has developed a fryer with a pumped tubular heat exchanger which has very high food production rates, and many other useful features. We have also done some work on fat circulation by means of a propeller in the fat. The use of the propeller to agitate the fat is a great aid in reducing kettle surface temperatures during heating-up and in collecting crumbs. However, during frying of foods, the circulation caused by frying produces the same reduction in surface temperatures as the propeller. For our heavy-duty fryer, therefore, forced circulation of fat is not required.

A heavy-duty fryer is not necessarily the best one for all jobs. For example, doughnuts float, and also require very little heat compared to potatoes. An efficient potato fryer might make a poor doughnut fryer simply because it has too much heat input and too little surface area, but the principles of design we have developed should apply in some measure to fryers built for any purpose.

I believe that we have definitely pointed the way toward significant improvements in gas fryers. Our suggestions have met with excellent acceptance from manufacturers of gas fryers, and several have indicated their intention to build improved models. It shouldn't be long before these are on the market, to demonstrate once again how research contributes to progress.

New Equipment for Underground Work

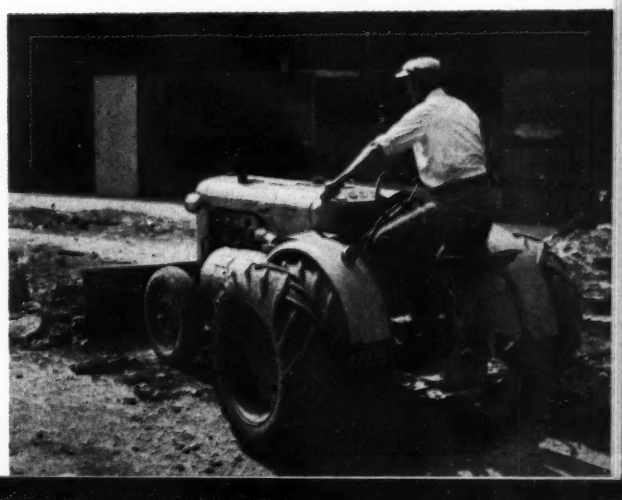
In keeping with the trend in the industry toward mechanization of every operation, GAS this month presents the first of two articles featuring the latest developments in mechanical equipment for underground work. While there is still much interest in mechanizing the larger operations such as trenching and backfilling, there is an increasing demand for improved mechanical equipment for such smaller operations as concrete and asphalt cutting and breaking, light backfilling, and soil compaction, handling, and removal. We have attempted to present a representative picture of the newest and best equipment for both types of operations as compiled from a survey of 21 gas companies across the country, made by Clifford R. Newlin of New Orleans Public Service Inc. For further information on any of this machinery write to GAS magazine, 198 S. Alvarado St., Los Angeles 4, Calif.

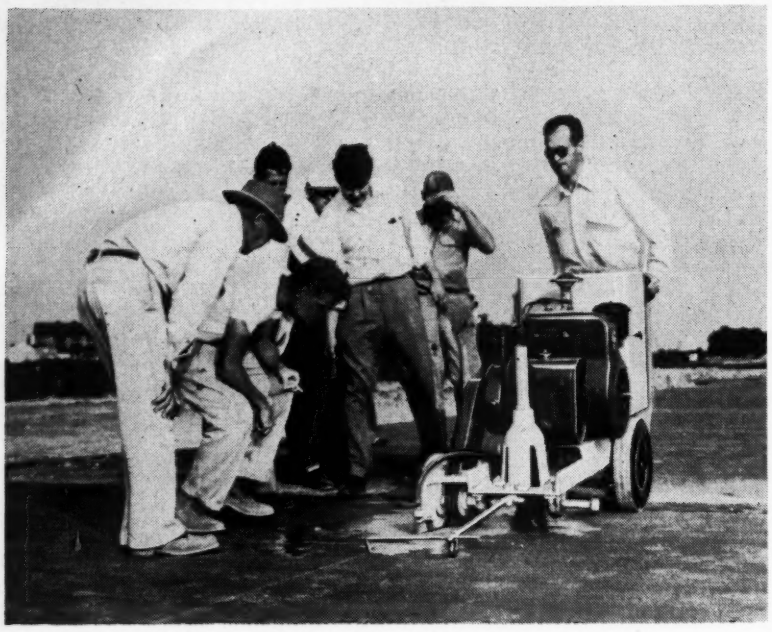
The Cleveland Tamper, Backfiller and Side Crane (above) is one-man operated and can fill, tamp, and travel simultaneously. The tamper unit is optional. The crane can safely handle three-ton loads at 3 ft out. It has 24 speeds in either direction, ranging from 1 ft per minute to 2¾ mph and can be operated safely on lawns and sidewalks.

A Runabout Ditcher (above) having an average digging rate of 7 ft per min. The boom comes in three sizes for digging trenches of 5½ in., 7½ in., or 10½ in. in width and approximately 3 ft in depth. It travels at 15 mph on the highway and the operator can start to work by merely lowering the hydraulically controlled boom.

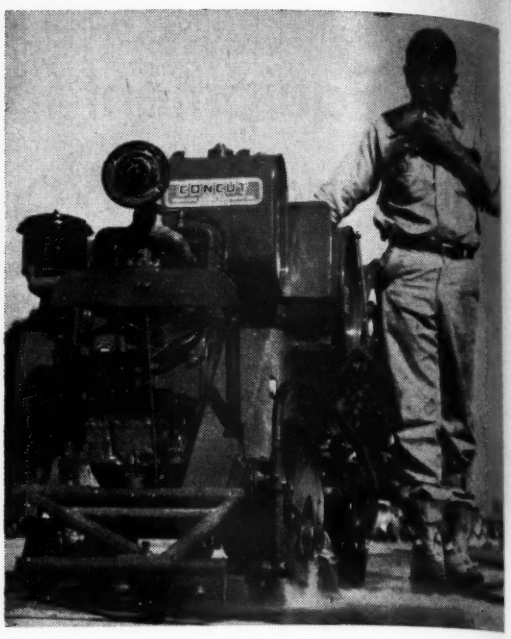
The Gunderson-Taylor Triplex Backfill Tamper (above) was developed to satisfy the need for a more efficient air tamper on the Colorado Big Thompson Water Diversion project of the U. S. Bureau of Reclamation. By putting three tampers together so that one man could operate the unit, it was found that one man could do the work of five. The three butts operate alternately so each butt gives a much stronger blow since there is no waste effort in recoiling as there is in individual tampers and the vibration stirs as well as pounds the soil particles into place. It requires only a 105-cfm compressor to do the job that would otherwise need at least a 160-cfm (and probably a 210-cfm) compressor. Hence it represents a saving of about $1600 over the cost of five individual tampers and a compressor.

The Le Roi Tractair (below) with hydraulically operated 5-ft backfill blade attachment combines a 105-cfm compresser with a 35-hp tractor engine giving, in a single unit, air power to open ditches or trenches and a hydraulically controlled front end blade to close them. Because of this feature it can reach places inaccessible to conventional compressors and it costs about $1000 less than the equivalent tractor plus 105-cfm compressor.

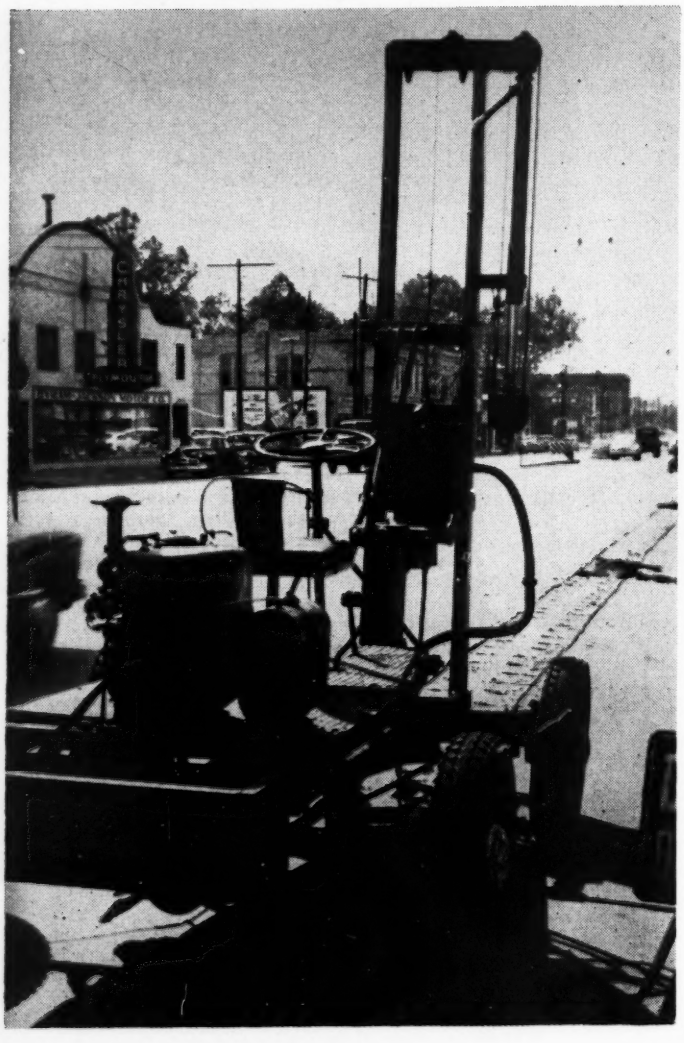




The Tri-Line Concrete Cutter (above) permits continuous or intermittent cuts on straight or curved lines at any desired depths up to 6½ in. It is powered by a 13-hp gas engine and is supported by a tricycle wheel gear. A hydraulic ram mounted over the front wheel raises the machine by means of a hand pump and lowers it by means of a single release valve. The diamond cutting blades are available in a variety of sizes for all types of work.



The Concut Self-propelled Concrete Saw (above) is similar to the Tri-Line. Use of these cutters saves on replacement of concrete or asphalt, speeds up the breaking operation, and eliminates the cracked and broken edges common in ordinary pavement breaking methods.



An example of concrete cut on both sides with a concrete cutting saw (above) after the material has been broken out with mechanical breaking equipment such as the Hydra-Hammer.

The Ottawa Hydra-Hammer (left) in action cutting asphalt. The asphalt is removed in pieces of approximately 20 in. by 15 in. This machine can also be used to break concrete and to tamper backfill.

Underground Boring Device as used by New Orleans Public Service Inc.

Step 1. Above left. The rail jack is used to punch a hole to provide the means for pulling the wire cable through to the tractor. Any other jacking or boring method can be used to accomplish the same thing.

Step 2. Above right. The double end bull plug has started to move under the street surface. The plug has two 6-in. heads on a 4-in. piece of pipe to provide bore for the 4-in. steel main. A crawler tractor and 10,000-lb winch is used. The plug follows the grade set by the jacking operation.

Step 3. Right. The bull plug is pulled free leaving a clean hole behind. This method has been used on sizes up to 20 in. and 100 ft in length. It is not satisfactory in dry sand or any soil that cannot be packed tight in a hole opening.

The Melfred Horizontal Earth Boring Unit (left) in operation. Water is circulated through the bit to wash out cuttings. This type of device, first used on the Pacific Coast, has revolutionized the methods of installing gas services in congested areas. Bores as long as 200 ft have been made under paved areas. In this boring unit, Thor motors are used to rotate the drill tubing, bits, and reamers which are made of alloy steels.

The Hydrohoe (left) has two separate digging motions. The first is obtained through a hydraulic ram located between the boom and the handle and the second comes from telescoping the boom. Every operation is fully hydraulic and control is precise enough so that the machine can operate efficiently around buried pipes and conduits.

The Sherman Power Digger (right) is a lightweight excavator of the back-hoe type designed for mounting on a standard lightweight rubber-tired tractor. (Illustration shows tractor equipped with half-tracks, which are optional extra equipment). Operation is entirely hydraulic with digging action accomplished by leverage instead of dead weight. It will reach to 8 ft below grade and swing through an arc of 140 deg for disposing of spoil dirt. It will clear 7 ft above grade for loading trucks. Digging thrust is absorbed by a hydraulically operated stabilizer assembly. Backfill attachments are readily attached to tractor in conjunction with the digger.

The Austin-Western Power Grader (left) has four-wheel drive and four-wheel steering, giving increased maneuverability and power. The blade has extreme reach for working on banks or shoulders, can be lifted 90° right or left, and is completely reversible. Many attachments are available including a scarifier, bulldozer, loader, and a roller.

Now We Have the Answer to "Black Iron or Equivalent"

By WILLIAM M. MYLER, Jr.
Surface Combustion Corp.
Toledo, Ohio

Four other papers, also from the AGA research and utilization conference in Cleveland in June, are condensed on the following pages.

ONE of the reasons why $90,000 of PAR research funds have been invested over the past 7 years in the DGR-4-CH project on "The Corrosion of Metals and Materials by the Products of Combustion of Gaseous Fuels" was the need for establishing a basis for evaluating the expression "black iron or equivalent," which has appeared in many AGA requirements for years. We now have reliable data on the subject; how long will it be before we take advantage of our new-found knowledge?

The study, assigned to Battelle Memorial Institute Oct. 25, 1945, is scheduled to be completed this year. Three reports have been issued: No. 1, in 1947, a literature survey which concluded that existing data on corrosion of appliances by products of combustion of gas fuels was entirely inadequate; No. 2, dated August 1949, describing test apparatus developed and reporting the corrosion behavior of mild steel under a wide variety of conditions which were considered to be representative of those found in some parts of every appliance; No. 3, issued last November, reported the next phase of study, the examination of other materials that might conceivably be used in place of mild steel.

Report No. 3 contains corrosion data on a wide variety of solid materials and coated materials which were investigated under test procedure identical with those used on mild steel.

This year, additional tests are being made at Battelle to determine what effects the fabricating processes, such as welding and bending, may have upon the corrosion behavior of materials. Results have indicated that welding techniques can be selected that will not seriously alter corrosion behavior characteristics.

Without delving into details of all the characteristics of all the materials investigated, let us explore some of the facts regarding mild steel check and see how they check with your own personal experiences. After the validity of the data has been established by relating it to your own experience, we can inspect the corrosion characteristics of certain other materials with which you have probably had no experience, but which appear from these data to be worthy of your careful study, indicating as they do that both improvements in appliances and worthwhile savings in costs of materials are possible by their use.

We are all familiar with the fact that when a gas appliance having flue passages made of mild steel fails in service due to flue gas corrosion, the failure first shows up as pin holes. Usually, the appliance is still structurally strong, but the holes cause flue gas leakage and hence the appliance fails.

The data in these reports on corrosion of mild steel confirm these facts. Two kinds of corrosion are reported. Average penetration is expressed in mils per year and is the total weight lost by the sample during the test divided by the weight of one mil thickness of the material which is the same area as the test sample. The other type of data reported is known as maximum penetration. It also is expressed in mils per year and is the maximum depth of the pits which have formed in the material. The depth of these pits is measured by means of a microscope. Thus, for each of the materials observed we have two values, average and maximum.

For mild steel under a typical cyclic test condition of 80° to 400° F and 25 grains of sulfur content per 100 cu ft of 1000-Btu gas, we find that the average penetration rate is 38 mils per test year and the maximum penetration rate is 410 mils per test year. The ratio of 410 to 38 or 10.8 to 1 simply means that the tendency to perforate the metal is almost 11 times the tendency to wear it down uniformly. Looking at it in another way, the sheet will be perforated when it has lost only 9% by weight due to over-all corrosion. This is a perfect explanation of the failure of mild steel by perforation when the unit is still structurally strong.

As you can see by thorough examination of the data of Report No. 3, 18-8 stainless, with and without molybdenum, Alclad 24S-T, 2S aluminum and copper all have both average penetration and maximum penetration rates which are very small when compared to the rates of mild steel. These materials are many times more expensive than mild steel, and for that reason they generally cannot be considered as substitutes for mild steel except in those instances where their extreme corrosion resistance can be used to advantage.

In the course of this investigation certain materials were examined which seem to be of particular importance to us because they have much improved corrosion resistance characteristics as compared to mild steel, and still their normal price ranges are not so far out of line with mild steel but what they can be attractive material for use in gas appliances. One such group of materials is what are known commercially as high yield strength steels. Four of these materials were investigated. They are Mayari R, Yoloy, Corten, and HT-50. In this group the average penetration rate was from 18 to 22 mils per year which is from 47 to 58% of the average penetration rate for mild steel. The maximum penetration rates for these materials ranged from 80.9 for Yoloy to

Burner Adjustment Device

The necessity of mixing sendout gases or of substituting one type of gas for another in emergencies requires that today's burners perform satisfactorily on a variety of fuel gases with differing combustion characteristics.

In present practice, burners are adjusted by eye, and a certain number of consumer complaints are to be expected after the initial use of a substitute gas. The AGA Laboratories are at present concerned with the development of an instrument for use by the servicemen to obtain the proper adjustment. While such a device is not expected to indicate what the correct adjustment will be, it being necessary for each gas company to obtain considerable data to predetermine the proper adjustment for its own individual conditions, the instrument would measure input rate and primary aeration corresponding with the predetermined adjustment.

Thus far, an instrument to measure air-gas ratios, based on the thermal conductivity principle, has been developed, but it is not yet suitable for field use.

—W. P. Kirk and E. J. Weber
AGA Laboratories
Cleveland

Utilization Labs

(The following is a review of four papers presented as a symposium in the "clinic" held at the AGA research and utilization conference. The four speakers —C. C. Winterstein, Philadelphia Gas Works; James Crane Jr., Chicago; Arthur E. Stack, Washington; and Harry L. Warren, Los Angeles—were giving their respective companies' answer to the question, "What Is the Role of the Gas Company Utilization Laboratory in the Over-All Gas Industry Picture?")

The philosophies which direct the operations of the four companies' laboratories have both common ground and distinct variances. In general, however, only the Los Angeles laboratory seems to vary strikingly from the others.

Philadelphia, Chicago, and Washington exercise considerable control over the appliances which are installed in their territories. They test those appliances which they merchandise, Chicago testing sample models of all sold in the area. They all set certain requirements above the AGA minimum, and both Philadelphia and Washington have supplementary utility requirements which must be met.

All four companies act as unofficial quality control agents for the AGA lab; cooperate with local health, safety, and fire authorities; assist lab in raising approval standards; work with customers service departments in solving unusual field servicing problems; do limited research and development work; give consultation and limited testing assistance to manufacturers.

The appliance laboratory at Los Angeles "neither approves nor disapproves appliances . . . all efforts to upgrade the construction and performance [being] directed primarily through AGA committees." Chicago goes "beyond AGA in safety and serviceability . . . because we realize these requirements are minimum standards and must apply to the country as a whole. Members of the committees [which establish them] do not always see eye to eye, and a utility cannot afford to compromise when it comes to the safety of its customers."

The Washington company believes that "certain local utility standards may be essential to insure proper operation of appliances with the particular composition of gas as distributed by the utility . . . Test gases used and pressures used by the AGA Laboratories are representative of the national situation, but at best must be a compromise of the innumerable actual gases and pressures used throughout the country."

Meter Inspection Plan

This program, only one of many periodic safety inspection procedures made by East Ohio, is conceived as a means of maintaining and improving the condition of the company's property and promoting safe and satisfactory gas results with gas equipment. While regular meter reader books are used, the job is done, not by regular meter readers, but by 30 special inspectors, usually former meter readers, covering the 650,000 meters in the system.

After the inspector has gained access to the property and has explained his presence to the satisfaction of the occupant, he proceeds to read the meter, checking condition and noting meter number for identification purposes; compares gas consumption with that of previous readings to establish that the meter is operating properly, making tests for leakage and accuracy if discrepancies are found. He inspects condition of meter connections and manifold, reporting poor condition or bad locations; looks for by-passes and irregularities, checks points of entry of service line; traces and inspects house lines. He inspects all gas appliances in the house, particularly flue vents and dampers, and takes steps to have faulty or unsafe conditions rectified. Upon leaving the premises, he inspects the ground over the service line for evidence of leakage or exposed lines, as well as curb boxes.

For 650,000 meters, the cost will run between $70,000 and $75,000 per year. Disclosures of faulty flue conditions in the Cleveland division (186,000 meters) dropped from 8221 in 1949 to 4074 in 1951.

—Kenneth Wood
East Ohio Gas Co.
Cleveland

96.0 for HT-50. Comparing these latter figures with the 410 mil rate for mild steel, their pit corrosion performance is 4.2 to 5.1 times as good as mild steel.

The ratio of the maximum to the average corrosion rates on these high yield strength steels is approximately 4 to 1 so the ultimate failure will still be by perforation. In the case of these materials, perforation will occur when about 75% of the original metal remains so the unit would still be structurally strong.

The really important consideration is the fact that the rate of perforation is only 20 to 25% of that of mild steel which would mean that when considered solely from the standpoint of corrosion, it would be possible to use a thickness of material that was only 20 to 25% of that required for mild steel. Let us combine these corrosion facts with the increased cost of these high yield strength materials over mild steel which is approximately 50% and we come up with some very interesting, attractive figures.

Consider a furnace made of 12 gauge mild steel which is 104 mils thick. This is the gauge material which is universally acceptable in manufactured gas territories as having a satisfactory life expectancy. These data would indicate that just as satisfactory a life expectancy would be obtained if the furnace were made of high tensile strength steel having 1/4 to 1/5 of the material thickness or an actual thickness of 21 to 26 mils. In this range we find 24 gauge material which is 24 mils thick. Structurally, this 24 gauge sheet might be too light for heat exchanger construction in the furnace, so let us consider the use of 18 gauge material which is 48 mils thick and which is a thickness that has been very commonly used in heat exchangers for natural gas furnaces.

Since this 18 gauge material is 40% of the original thickness and since these corrosion data would indicate that material 20% of the original thickness would have the same life expectancy, then this 18 gauge material would have twice the life expectancy of the original 12 gauge material. On the other hand, based on a 50% price premium for high tensile strength steel, the material cost for the 18 gauge furnace would be only 60% of the original 12 gauge furnace.

These data indicate that such a change would decrease the material cost 40% while doubling the useful life.

Another relatively low cost material which showed exceptional resistance to corrosion is aluminized steel. This material costs about twice as much as mild

steel. Under the same test conditions as previously used for mild steel and the high tensile strength steels, we find that aluminized steel has an average penetration rate of 10.6 mils per year and a maximum penetration rate of 12.3 mils per year.

Note that the ratio of these two penetration figures is altogether different than the ratio for the other materials previously examined. The maximum penetration rate is only 16% higher than the average penetration rate indicating that the tendency to perforate the material is extremely small. In the case of the mild and the high tensile strength steels, we had from 90 down to 75% of the original material remaining at the time of perforation, while in the case of aluminized steel there would be only 13.8% of the original material remaining. These data would seem to indicate that the appliance would probably fail structurally before there is any likelihood of perforation. It should be obvious that, in the applying of the corrosion data for aluminized steel, it is the average rate of corrosion that is going to be the governing factor and not the maximum rate.

In the Battelle tests no attempt was made to correlate the test year with a calendar year. Examination of the rate of corrosion indicates quite clearly that the Battelle tests were greatly accelerated tests. As an example, consider mild steel, which is being corroded at the 410 mil rate per test year. A 12 gauge sheet which is 104.6 mils thick would be perforated in 0.256 years and yet it seems to be pretty generally accepted that a 12 gauge sheet even in manufactured gas territories will have a useful life of 20 years as a minimum. Despite this great acceleration in test rate, the performance ratio between the different materials should be exact because test conditions were identical and hence the results should be exactly comparable.

If we accept as a fact that a furnace of 12 gauge mild steel plate will have a satisfactory life in manufactured gas territories of 20 years, we must also assume then that the unit is still in usable condition at the end of that time and that some longer time, perhaps 30 years, represents the time of ultimate failure, due to serious perforation. Since the 12 gauge sheet is 104.6 mils thick originally, then the pit penetration rate per actual or calendar year is 104.6 divided by 30 or 3.5 mils per calendar year. The Battelle data say that 410 mils per test year is the rate for the same material. so the ratio of test year to calendar year would appear to be 410 to 3.5 or 117 to 1. Let's round this off to 100 to 1.

On the same basis the actual average penetration per calendar year for aluminized steel would be 10.2/100 or 0.1 mil per year, or 3.0 mils for the 30-year life.

If we go back to our previous example and were to substitute 24 gauge aluminized steel for the 12 gauge mild steel, at the end of 30 years the material would have decreased from its original thickness of 24 mils to 21 mils. Eighty-eight percent of the original material would be left. Since the pit penetration rate for the material is only 16% more than the average penetration rate, then the greatest depth of pits on the corroded surface would only be 0.5 mil.

Aluminized steel is a coated material as compared to the solid materials previously discussed. The data reported above on aluminized steel were obtained on undamaged samples. It was natural that the question should be raised as to the effect of scratches and manufacturing processes on the corrosion resistance of this material, so intentionally damaged samples were subjected to the same tests and samples involving various types of welding procedures were examined. The results obtained on these intentionally damaged samples resulted in corrosion rates which are less than double the original figures. This would mean that in the worst corroded spots the 24 gauge sheet would be reduced to 18 mils in 30 years and that the pits in this area still would only be 1.0 mil into the surface instead of 0.5 mil which would still indicate an extremely superior material.

No claim is being made that the Battelle tests have completely answered every aspect of the flue gas corrosion problem. It should be emphasized, however, that the mild steel investigation reported in Report No. 2 is quite exhaustive and a study of it reveals that it does check with our long time field operating experiences. Since the data on other materials are directly comparable to the data from mild steel, there should be no reason to doubt its applicability.

Committees have argued about the "black iron or equivalent" expression for years, at least 20 years in my own personal experience, and they have repeatedly asked for reliable data. Seven years ago the PAR committee started providing money to get this information and to date has spent $90,000 in this search. Now that we have it, how long is it going to be before we really take advantage of our knowledge?

Range Ignition Systems

In my opinion, the gas industry now has available a number of automatic range ignition systems which will win the approval of the utility and the customer. Complaints that have come to light in the field test program will or have already been corrected.

The latest laboratories report available is the sixth, covering the period from Sept. 1, 1950 to Dec. 31, 1951, at which time 1001 ranges were in operation. The average length of service for each of the ranges at that date was 6½ months. With 300 ranges having been installed since then, field data today would cover well over 12,000 range-months of service.

As a goal in the program, 200 ranges equipped with each type of the 10 ignition systems were to be tested.

Here are the results of the test as revealed in the sixth report:

1. The sixth laboratories report covers 6511 range-months of operation and is based on 3272 monthly reports and 456 special reports.

2. A total of 1589 complaints were noted on the reports—676 on items irrelevant to the broiler or oven ignition system and 913 *which were relevant.*

3. When related to length of service the relevant complaints for all ranges resulted in 0.139 service calls per range-month of operation or 1.66 service calls per year of operation for each range.

4. Ranges with *electric ignition systems* averaged 0.155 relevant complaints per range-month or 1.86 service calls per range per year.

5. Ranges with *single point ignition systems* averaged 0.116 relevant complaints per range-month or 1.40 service calls per range per year.

6. Sixty-eight percent of the relevant complaints on electric ignition systems were due to four specific troubles. Two of these are directly related to proper adjustment and should be substantially reduced as service personnel become more experienced with these new devices. The other two major troubles are due to constructional weaknesses and will have to be corrected by design improvements.

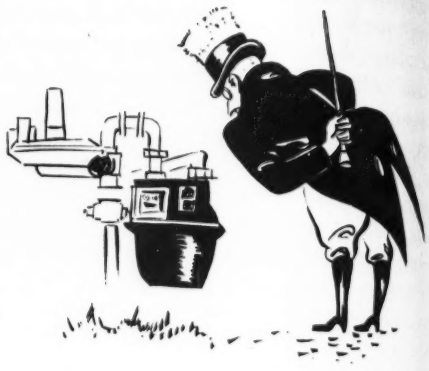
7. Seventy-six percent of the relevant complaints on single point systems were also traceable to four specific troubles. In this instance, three were due to improper adjustments and only one to design weakness.

8. It is interesting to note that customer opinion complaints were very few. For all the test ranges only 27 such complaints were reported, 19 mentioning slow ignition, two observing odor of gas, and six objecting to the noise of ignition.

9. Another point of interest is that the ignition system which shows up best is a single point system with 0.084 complaints per range-month. However, another single point system has the highest rate of complaints, 0.228 per range-month.

—Edgar A. Jahn
American Gas Association

John Bull Looks at The U. S. Gas Industry



The following comments on the U. S. gas industry were made by J. H. Dyde, president of the British Institution of Gas Engineers, who recently headed a 16-man delegation to this country from England. The delegation spent six weeks here studying our gas operations in an attempt to find solutions to their own problems.

Mr. Dyde, on the whole, was very favorably impressed by us. By noting the things which impressed him the most we can get a pretty good picture of differences between our gas operations and those in Britain.

On appliances. "It is well known that Americans are gadget-conscious, and all their appliances bristle with such devices . . . The sales aim is to secure constant turnover . . . an appliance does not generally become worn out, but outmoded. In assessing the marketing value of an appliance . . . dressy appearance . . . or automaticity is more important than thermal efficiency.

On dumping. "There would seem to be divided opinion as to the extent to which [dumping] . . . should be pursued. . . . Nevertheless, the principle of selling on an 'interruptible' basis . . . may well have application in industrial areas of this country.

On customer charges. "Billing is done on a monthly basis . . . and the rate is essentially what we know as a block tariff . . . This . . . has much to commend it, particularly insofar as it takes care of the unremunerative customer . . . In Britain, where we must continue to rely almost entirely on manufactured gas, the production cost . . . is now 70 to 75% of the total charges . . . The promotional possibilities of any of our British tariff structures is, therefore, severely limited.

On appliance dealers. "Perhaps the greatest contrast in policy between this country and the United States is in the commercial field . . . in the extent to which 'contracting out' is employed. The utilities . . . generally do little direct selling. This is left to approved dealers, who also undertake the installation work and the servicing of the appliances . . . There has always been a strong dealer organization in the States . . . and our British ironmongers and plumbers hardly come within the same category . . . it was understandable that the utilities should want to make full use of these powerful and influential selling agencies in promoting the sale of gas . . . I gathered, and this was a personal impression, that during the latter days of manufactured gas, servicing costs had been hampering competition . . . In other words . . . the gas undertakings settled down to sell primarily their commodity gas, and not gas service.

On meter reading. "Over wide areas of the country . . . meters, quite unprotected . . . are fixed at ground level along the house flank . . . meters are easily read, and a high rate of reading results.

On customer service. "Attention to customer calls . . . [are handled by] operators, usually girls, highly schooled to their job, courteous, and pleasant of voice . . . Such service . . . is first-class, speedy, if somewhat costly, but the margin to support the cost is certainly there with cheap natural gas.

On industrial gas utilization. "Methods of application run parallel, except that in the States there is a greater degree of continuous conveyor heating, and not the same attention is or need be paid to thermal efficiency and heat economy.

On use of steel mains. "We had to conclude that there was insufficient evidence to cause us to depart from our own established practice of laying mains carrying up to 25 lb per sq in. in cast iron with mechanical joints.

On leakage surveys. "Most utilities undertake periodic leakage surveys on their main systems, and this may, with advantage, find application here.

On manufactured gas. "There are no small carbonizing plants remaining in the States; such carbonizing as remains in the gas industry is carried out in orthodox coke ovens. We had to visit steelworks to secure certain information on coke oven practice and on liquid-purification technique.

On L.P. gases. "We learned that there are some 400 small communities employing these gases . . . The liquid gases need special care in transport, storage, and handling, of which we have had little experience in this country, and it is essential that a general safety code involving the installation and operation of storage units be prepared . . . it was further suggested to us that good business would be obtained by using the storage tanks for filling gas into bottles and selling it to scattered dwellings and farms, particularly as a fuel for tractors and heavy vehicles, for it gives easy starting and a huge mileage between engine overhauls.

On employee relations. "We found very good relations between management and employees in all the companies we visited . . . Management goes to very great lengths to keep all employees informed about the company's activities and the aim and purpose of the policy it pursues . . . The Americans, like ourselves, have found that the gas industry does not lend itself to direct incentive schemes . . . The desire on the part of the worker to improve his standard of living and add to the amenities to be enjoyed by his family is a great driving force behind American productivity."

Safeguarding Low Pressure Systems Against Excessive Pressure

By P. W. HAVENSTEIN
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Boston

PROTECTION from excess pressure, particularly in low pressure distribution systems, is a subject that was discussed on several occasions at the recent April AGA distribution and corrosion conferences in Philadelphia. There was also a panel discussion of the present practices in the use of pressure control and relief devices. These discussions showed that a great many gas utilities had installed pressure reliefs, generally of the venting type, at those regulator stations where they considered critical conditions existed, *but there was no agreement on either the proper design for these reliefs or, what is of prime importance, the maximum safe operating pressure to which a low pressure system should be subjected.* The opinions on a safe maximum operating pressure in an emergency ranged all the way from 7 in. of water column above normal operating pressure to a total pressure of 2 psig, the feasibility of which was being investigated in tests by one company.

Regulator Failure

The purpose of this paper is to describe and comment on various methods of safeguarding low pressure distribution systems which are supplied with gas from sources of higher pressure, against pressures in excess of safe operating levels. Mostly we are concerned with protection against faulty operation, or even complete failure, of pressure regulators.

Protection against excessive pressure from faulty regulators is not a new problem. For years gas companies have used pressure controls for a minor part, if not for a major part of their gas distribution. Now, due to the advent of natural gas in large areas previously served with manufactured gas at low pressures, the number of pressure regulators in service will be greatly increased and the duties placed upon them made even more exacting. Hence, precautions against failure of these controls is of increasing importance. Even the very small distribution system supplied from a low pressure holder will now probably have a pounds-to-inches pressure regulator to fill the holder, or to serve the distribution system directly.

District Regulators

The increase in natural gas sales certain to occur will make it necessary to increase rather soon the capacity of most distribution systems. Where an area is now served from a low pressure system, generally the most economical way to get a greatly increased quantity of gas into the area is through new high or intermediate pressure gas mains discharging through strategically located district regulators because natural gas will be available at pressures up to 100 psig and there will be no pumping expense. This means that there will be more and more district regulators added to supply low pressure distribution systems and, therefore, more opportunities for trouble.

One trouble to be expected at first will be from leakage of gas through some existing regulators which have suddenly become over-size at the lighter loads on the mains. Immediately after conversion from, say, a 528-Btu manufactured gas to a 1000-Btu natural gas, the volume of gas used by customers will be approximately half of what it was before conversion. As the normal leakage will be substantially the same volume as before from such regulators if receiving gas at the same upstream pressure, excessive pressure may now build up where before it did not because the leakage could be absorbed by the minimum demand. Similarly trouble can occur from any new regulators that are much over size for the duty to be performed. Too greatly oversized regulators will demand closer throttling which may result in excessively rapid cutting of the valve seats, particularly if dust is carried by the gas. Dust which is to be expected from new pipelines can also be picked up in old lines where the velocity of the gas flow is increased, or the direction of flow is reversed.

Top Pressure Limit

The first thing a gas utility must do in providing protection against excess pressure in its low pressure system is to decide on the top limit for the safe operating maximum pressure. For this top pressure limit is one of the principal factors determining both where supplementary control for safety should be installed and what the design of such a control should be. Then the effect of imposing such top pressure upon each regulator station should be studied, the probabilities of exceeding it considered, and the time it would take should the top pressure be exceeded for the maximum pressure to be attained throughout the area served, if the regulator stays wide open. For example, a small area with small distribution mains served by a single regulator receiving gas from a high

This paper was presented at the NEGA operating division meeting in Providence, R.I., May 14.

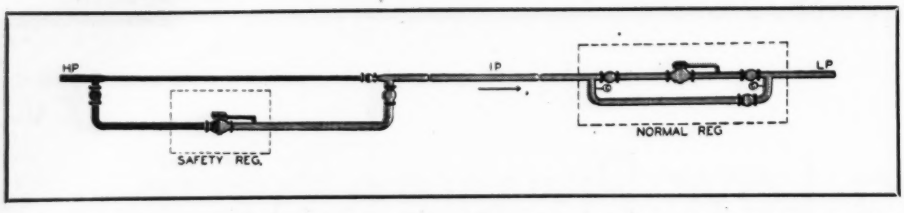


Fig. 1. In this arrangement the safety regulator is upstream from the normal controlling regulator, and the outlet pressure control piping of each regulator is connected just downstream of the regulator. The safety regulator will be functioning all the time, reducing the higher pressure to an intermediate pressure which is the maximum permissible for the lower pressure main.

This arrangement is well suited for the protection of intermediate pressure, cast iron mains with bell and spigot joints that have not been leak clamped and are being supplied from a high pressure source. In this case, the safety regulator can have a discharge pressure of, say, 15 psig if the outlet of the downstream regulator normally controlling is 5 to 10 psig. Applications where the normal regulator is discharging at low pressure are limited because it would have to be of relatively large size as the pressure differential available for the maximum discharge would be only a few inches of water column. Where the regulator now controlling the pressure is of ample capacity, as many existing regulators are because they are receiving gas at only a few psig, this arrangement may be applicable.

The advantages of this arrangement are that the outlet control piping is short for each regulator and the safety regulator is working all the time. That it is functioning properly can be checked by the pressure recorded just upstream of the normal control regulator.

pressure source (such as 50 psig), would build up quickly to the upstream pressure if the control failed whereas a large area with relatively large distribution mains and served by a number of regulators receiving gas from an intermediate pressure system (say, 5 psig) would build up pressure slowly enough to give the utility a warning of an abnormal condition before the pressure became dangerous. This second example is illustrated by the experience of a certain large gas company where the low pressure system is fed by many regulators from mains carrying 5 to 10 psig pressure. The bypass valve of one of the regulators was opened by an accident unknown to the gas company, yet the pressure in the low pressure system built up only to 20 in. of water column, at which time it was discovered and controlled.

Excess Pressure

In general, there are several ways of providing against excess pressure in a distribution system. One is to connect a relieving vent to the gas main downstream of the pressure regulator that will open at a pressure which will limit the maximum pressure in the distribution system. Another way is to put a second pressure regulator in series with the normal controlling regulator that will check the pressure rise if the normal controlling regulator fails. Then there can be a shutoff valve to close off the gas supply in the event of the regulator failure.

The pressure release vent can be provided by a liquid seal or a mechanical relief valve. The liquid seal can be either a "U" tube or dip pipe using an oil that will not freeze or evaporate in any temperature range likely to be experienced. The oil seal generally has been used by the gas companies up to this time for protection of their low pressure systems because it is the most economical to install, has no leakage, requires practically no maintenance, and is foolproof in its operation. But probably most of the vents of this type now installed have been designed primarily to discharge the possible excess from a regulator that is in maladjustment and not to take the full discharge from the regulator should it fall wide open.

The oil seal must be properly designed, making certain that if the seal blows and the regulator is again in control of the pressure, the seal is not open to the atmosphere permitting the low pressure system to become exhausted. An oil seal can be designed so that not all the oil will be blown from the seal, unless the blow is of very long duration. This is illustrated by the experience of an eastern gas company when on the occasion of a wet snow storm followed by an extremely heavy rain, three regulator pits were flooded, resulting in the regulators probably going wide open. Downstream from the regulators were installed oil seals consisting primarily of 3-in. pipe dipping in a vertical leg of 12-in. pipe. The seal was about 25 in. of water column. Before the regulator pits could be pumped out and the regulators made to function properly, a pressure of 42 in. of water column had built up in the low pressure system but there still was sufficient oil left in the oil seal to hold the normal operating pressure of 7 in. when the regulators began functioning again. The principles of a well known gas cleaner may be used for the dip pipe type of liquid seal. In this cleaner the gas swirls through the cleaning oil from the base of the unit and, after passing up through baffles, the remaining oil in the gas is removed by a mist extractor and returned to the base. This unit, if provided with a dip pipe in the base in place of the mixing nozzles, could be used although its capacity is rather limited.

Mechanical Relief Valve

The mechanical relief valve, which may be a back pressure regulator, is also widely used to vent for pressure relief and has the advantage over the liquid seal in that it can be made self-closing without the danger of losing the sealing medium when the pressure returns to normal. It is practical for all pressures whereas practical applications of the liquid seal are limited to low pressure systems and relatively smaller capacities. Such a valve should preferably be installed some distance downstream of the pressure control regulator on a special branch from the gas main. Because it is always rightly closed, when called on to function it may stick. For this reason, to obtain greater operating reliability, the best practice is to install the weight or spring type of relief valves in multiple. For example, if a valve of 10-in. capacity is required, three 6-in. valves mounted on a common header could be used. When used to protect a low pressure system, a relief valve must function in a narrow low pressure range and, as already men-

Fig. 2. A second possible arrangement is to reverse the positions of the two regulators from that of the first arrangement so that the normal controlling regulator is now upstream. The safety regulator would be now normally wide open and even though it must be relatively large, being downstream of the control point, the pressure loss through it, even though slight, would result in poor control of the final pressure which would be variable. This is indicated by the letters VP.

tioned, may stick. It is also subject to leaking. For these reasons relief valves should be inspected and tested rather frequently. Where the relief valves are set to open at a pressure considerably higher than the operating pressure (say one psig for a low pressure system) then special provisions must be made for testing. One way would be to shut off the relief valve from the system and apply pressure to the valve from some outside source such as from cylinders of compressed CO_2 or N_2.

Vent Location

A vent from a low pressure system except possibly at a holder station must be discharged into the atmosphere. The vent may be located close to the regulator station or some distance from it if the intervening mains are large enough to prevent development of too much back pressure. If a spot can be found where this vent can be located and where a new hazard will not be created if it should blow, then this type of pressure protection should be considered. Unfortunately, most of the regulator stations are in congested areas where a large gas vent cannot be located with safety.

The gas that could be discharged from a relieving vent may be very considerable and should be estimated before this type of pressure control is decided on to assure safety. Take a hypothetical case, such as a low pressure main supplied through a regulator from a high pressure source. Assuming that the inlet pressure to the regulator may reach 50 psig at times of light loads, and that the pressure in the low pressure main shall be limited to 15 in. of water column, the differential forcing the gas through the regulator is approximately 49½ psig, whereas the differential through the vent to atmosphere is only ½ psig. If the regulator is a standard 3-in. regulator, then the relief would have to be approximately 12-in. size. In the event a district regulator failed and remained open and its full capacity was vented to the atmosphere, there is also the possibility of pulling down the pressure in the high pressure supply resulting in poor pressure for the remainder of the distribution system.

Whenever the vent protection is used either with oil seals or relief valves some arrangement should be made or facilities provided so that the gas company may be notified if the seals are blowing. The representative of one of the larger gas utilities, having about 150 district regulators installed in the distribution system, stated that the company had 25 pressure points telemetered to their central station. One arrangement that has been made in case of a regulator installed in a small building on a sizable plot is to place a warning whistle at the top of the vent. This particular whistle is the type used on oil filling systems for heating plants in residences but we understand that its effectiveness is diminished at high velocities.

Up to this point we have covered the type of seals and valves that can be used to relieve excessive pressure and prevent further build up of pressure after it has developed on the downstream side of a pressure regulator. It is entirely practical to prevent the occurrence of pressure in excess of what is considered to be a safe pressure by the installation of a second regulator or so-called safety regulator in series with the normal controlling regulator. This safety regulator should be installed in its own pit or structure with an independent outside bypass and separated from the normal regulator by a distance that will prevent an accident to one of the regulators should the other one be damaged. Besides functioning as a safety regulator it can also be used as the controlling regulator when the normal regulator is being bypassed for maintenance.

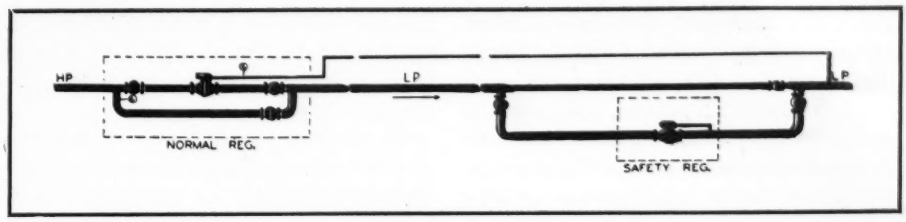


Fig. 3. In a third arrangement designed to provide for the loss in pressure through the safety regulator that occurs in No. 2, and permitting use of a smaller valve, the outlet pressure control piping for the normal regulator can be taken from the main downstream of the safety regulator. The normal regulator discharge pressure will now be the low pressure plus loss through the safety regulator which is normally wide open.

There are sometimes controlling conditions where the proper location of the safety regulator is downstream of the normal regulator. For example, in the new construction for natural gas by New England Electric System companies, installations in accordance with this arrangement have been proposed at Gloucester, Mass. and Warren, R.I. In these two cases the safety regulator cannot be put upstream of the city gate station, and since the station building is the better place for the control regulator, the safety regulator is put downstream in an outside pit. To check the operation of the safety regulator when it is downstream, the discharge pressure from the normal regulator must be stepped up above the setting of the safety regulator and the final downstream pressure observed.

Series Arrangements

There are many ways a safety regulator may be used in series with the normal controlling regulator. Although there is one arrangement (No. 4) that appears to have all the advantages, the choice of one of the other possible arrangements may be necessitated by prevailing conditions. A brief outline of the principal features of four series arrangements of the safety regulator and a normal control regulator is shown in *Figs. 1, 2, 3, & 4.*

The third and fourth arrangements for safety regulators can be designed to give ideal protection to a low pressure system as the safety regulator can be set to lock up from 2 in. to 5 in. of water column

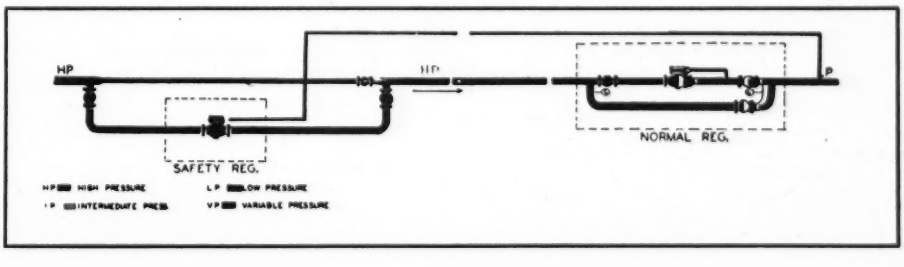


Fig. 4. A fourth arrangement is to put the safety regulator upstream of the normal control regulator with its outlet pressure control piping connected to the gas main downstream of the normal regulator. This arrangement will generally be the one to use. It will be normally open and have little or no influence on the functioning of the normal control regulator and can generally be the same size as the normal regulator. In the case of installation of existing district regulators, this arrangement has the further advantage that the cut-ins for the safety regulator can be more readily made as they will be in the higher pressure piping which generally is steel and smaller in size. To test the safety regulator in this case, the discharge pressure from the normal regulator must be stepped up above the setting of the safety regulator, and the final downstream pressure observed.

above the maximum operating pressure and control the pressure slightly below that level.

The upstream regulator, whether it is the safety or normal regulator, must be designed so that the pressure in the outlet side of the valve body does not take over control, when the pressure control piping is downstream of the downstream regulator, as in the third and fourth arrangements. That is, there cannot be a free flow between the valve body and the diaphragm case; otherwise, the valve body pressure will control instead of the pressure from the control point. A small molded diaphragm attached to the valve stem and to the bottom of the diaphragm case will prevent leakage around the stem, but it can be used up to a few pounds pressure only. At higher pressure the force on this small diaphragm becomes an unbalanced load and hinders the proper functioning of the regulator. For the higher pressures the valve stem must be sealed in some other manner to control leakage by the stem. As this sealing of the stem may make the regulator less responsive, it is better to have this feature on the safety regulator. This is another reason favoring the fourth arrangement.

These descriptions and comments cover four primary arrangements of the normal control regulator and the safety regulator. By means of special types of loading, and use of small auxiliary regulators in the pressure line, various features can be added. With these devices provision can be made so that in the event of a break in the long pressure control line required in the third and fourth arrangements, the upstream regulator will not go entirely out of service. Also in the fourth arrangement a control line just downstream of the safety regulator can be added which under normal conditions will keep this regulator functioning as the first step regulator; but in the event the pressure downstream of the normal control regulator rises 2 in. to 5 in. water column above the normal maximum, this pressure will take over control of the safety regulator.

In the discussion of pressure control so far we have taken for granted that gas pressure must be maintained from the regulator station as is generally the case in the smaller distribution systems. Therefore we assume that the normal control regulators will drop open with the failure of their diaphragms or control piping, so a complete shutoff of gas would be very unlikely. There are, however, regulator stations that may be shut off such as a regulator that normally opens only during peak demands, a regulator that is one of two or more regulators supplying a single connected area, or one that supplies a single industry. A faulty regulator may be shut off from the system by pressure-operated shutoff valves that can be reopened manually or automatically when the pressure has returned to normal. The shutoff valve would be installed in series with the normal controlling regulator in either the third or fourth arrangement shown.

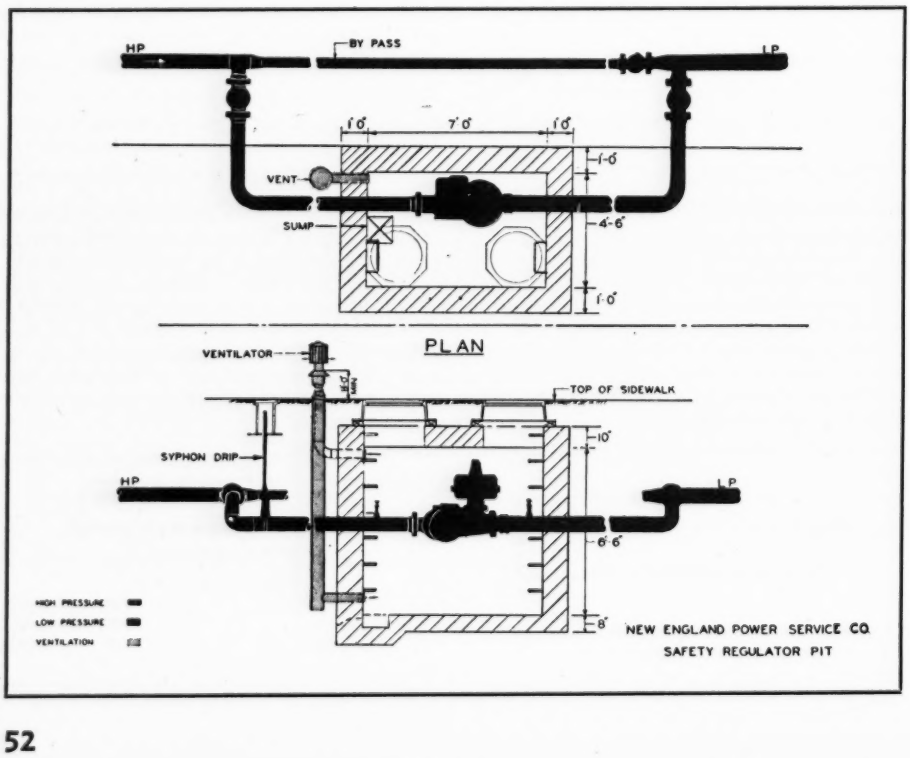
Putting the second regulator in series with an existing regulator, regardless of position of the new regulator, reduces the available capacity of the existing regulator.

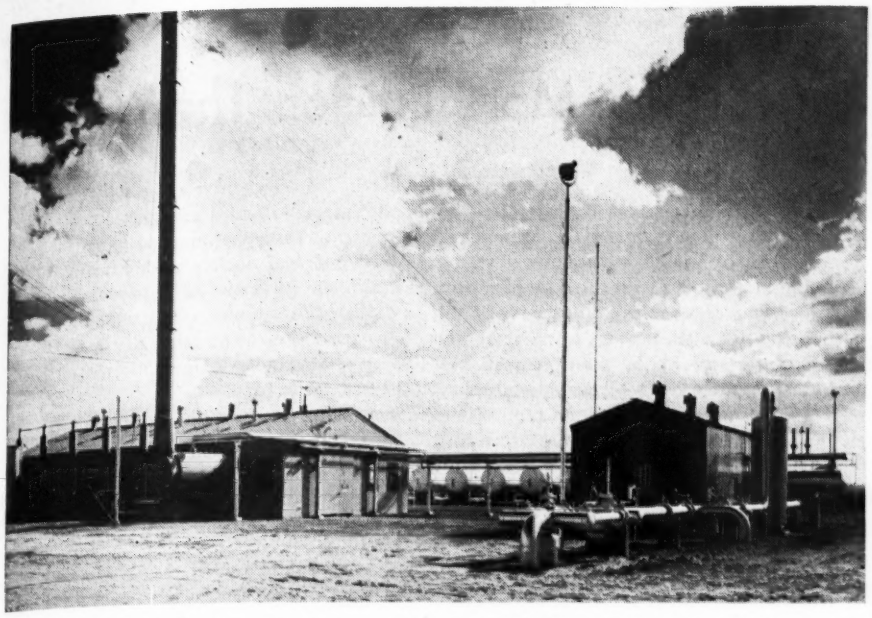
The available capacity of two regulators in series will be approximately 70% of the average of the capacities of the two regulators with the same overall upstream and downstream pressures. Fortunately, there is ample capacity in most existing regulators due to the decrease in volume of gas required with the changeover to natural gas and because of possible increase in upstream pressures to offset this handicap.

The cost of installing a safety regulator in a pit to protect a district regulator should be about the same as that of a mechanical relief valve. For the relief valve there would be more opportunity to avoid locations requiring expensive construction and no by-pass is required. But to restrict the rise in street pressure to the same limits possible with a safety regulator will require a much larger relief valve or multiple relief valves and probably a larger pit. The oil seal can be installed at less expense as no pit is required, but it is only practical to handle flows much smaller than the full discharge from a district regulator.

In describing the various primary arrangements of the normal control regulator and the safety regulator it was pointed out how the operation of the safety regulator can be checked by the gauges in the pit of the normal control regulators. Therefore, the safety regulator pit needs to be entered only infrequently.

Fig. 5. The New England Power Service Co. has designed a small regulator pit which will be generally used wherever a pit is required to house the safety regulator. This is shown in Fig. 5. Inside, the pit is 4½ ft x 7 ft in plan and 6 ft., 4 in. high. The walls are 12 in. thick plain concrete, the floor 8-in. thick reinforced concrete, and the roof a 10-in. slab of reinforced concrete. Wherever possible, a sidewalk location will be used but the design is such that it can be put in the street either originally or when the street is widened. It is provided with two manholes, each over a ladder set in the end wall. There are two 4-in. vent connections in the walls one near the top, and the other near the bottom. A 4-in. pipe from the bottom connects to a 6-in. riser that ends at least 8 ft above the sidewalk with a rain hood; a 4-in. pipe from the top of the pit is carried up in the center of the 6-in. pipe approximately 24 in. above the rain hood where it is topped with one of the patented exhaust heads. There should be not less than 25 ft between the normal regulator pit and the safety regulator pit, and the shutoff and by-pass valves for the safety regulator should also be 25 ft away from the new pit, if possible.





The standby plant showing the compressor house and boiler on the left and the control house on the right. The storage tanks are in the background.

The Southwest's Largest Standby Plant Provides Insurance for Southern Union

SOUTHERN Union Gas Co.'s peak shaving plant near Albuquerque, N. M. has proved to be good insurance against emergencies and extremely cold weather peak demands.

Exclusive

The largest peak shaving plant in the Southwest and one of the largest in the country, it was built by J. F. Pritchard & Co. of Kansas City, Mo.

Completed in the fall of 1951, the $700,000 standby plant was not called on in the winter of 1951-52, Southern Union being able to handle the peak demands with the regular natural gas service facilities. However, the plant has had numerous trial runs in order that a number of employees at Albuquerque might be trained in its operation.

So completely automatic and accurate are the controls that only two men to a shift will be required to operate the plant. Presently one employee is stationed there.

Since it was designed primarily to take care of Albuquerque's emergency requirements (Southern Union's peak load in New Mexico is at that point) use of the plant when necessary will release large quantities of natural gas to Santa Fe and other communities in the gas company's northwestern New Mexico district also.

The plant consists of two fireproof buildings, a control house and compressor and boiler house both constructed of steel and concrete, and 10 storage tanks, each of 30,000-gal. capacity. The compressor house contains five compressors, each powered by a 330-hp natural gas engine, and the Lucey gas-fired, locomotive-type boiler (150 hp), which furnishes steam for the propane vaporizer. The automatic controls in the control house are separated from the vaporizer-mixing compartment by a vapor-proof partition.

The plant has been so planned on the 12-acre tract it occupies that 30 more storage tanks of the same capacity can be installed. This forward-looking plan was evolved to take care of the rapidly expanding city of Albuquerque and the other 11 cities and communities in that area served by Southern Union.

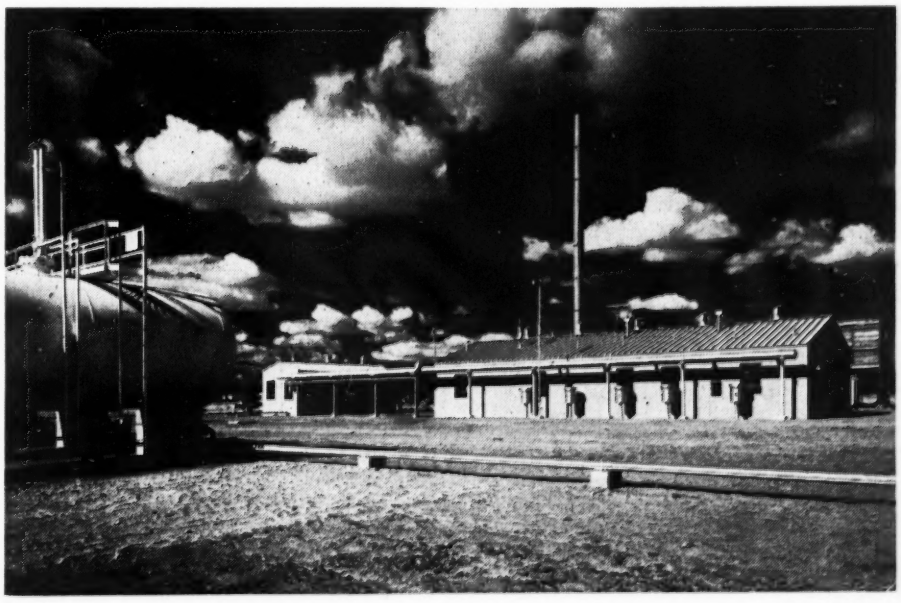
The plant is designed for a capacity of 1 MMcf per hour of 1445 Btu propane-air gas, but at the present time it can deliver 350 Mcf per hour, with only two of the five compressors being used.

Propane is brought to the plant in trucks and transferred to the 10 storage tanks by means of an unloading compressor. Each tank is filled 90% with liquid propane, making a total of 270,000 gal. Without any additional propane being brought in, the plant could produce the equivalent of 24 MMcf of natural gas.

A 4-in. liquid propane line and 2-in. vapor line lead from the unloading compressor to the storage tanks, and another 4-in. line carries the propane on to the control house. These lines are aboveground for both safety and maintenance reasons, just as is the 20-in. air line from the compressor house to the control house. Several pressure control valves are in the propane line.

Two vertical electric pumps force the liquid propane out of the storage tanks

In the foreground are the 4-in. liquid propane line and the 2-in. vapor line. In the background is the air line which runs high above the ground to the control house.



and through a 4-in. line into the heat exchanger where it is vaporized to make standby gas. On warm days the pumps are not needed as the normal vapor pressure of propane will transfer the liquid. For emergency purposes a third method of transferring the propane has been made possible by tying a high-pressure natural gas line into the vapor line.

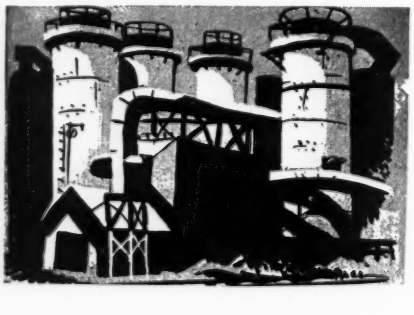
The heat exchanger, located just outside the control house, is heated by the cooling water of the compressors and inter-coolers. From here the propane goes into the vaporizer, built partly outside and partly inside the control house, and then into the superheater, which is inside the control house. Both the vaporizer and superheater are supplied with steam from the boiler and have temperature controls.

After the propane has been vaporized and reheated, it goes through the control valves into the mixing tank. Air enters the mixing tank from the two-stage compressors, equipped with inter-coolers, through the 20-in. air line, which runs about 12 ft aboveground from the compressor house to the control house.

With a ratio of about 50-50, the propane-air mixture contains 1445 Btu and is completely interchangeable with the natural gas (1065 Btu). The heat content of the propane-air is measured by the Cutler-Hammer calorimeter. This also is in operation when the standby plant is idle, because the calorimeter is used to measure the heating value of the natural gas distributed daily and to provide a continuous record.

The desired mixture is maintained by an Askania valve controller in the propane line. Should there be a surplus of air or a surplus of propane, the calorimixer indicates it and the Askania control automatically regulates a butterfly valve which opens or closes in the propane line and allows more or less propane to flow across the orifice.

After the propane-air mixture leaves the mixing tank, its flow is measured by an orifice meter. In the event of an electric power failure at the plant, an emergency 60-kilowatt gas-driven engine could generate all the electricity needed.



Gas Heat More Efficient Than Oil

In order to develop a valuable tool for use in the competitive oil-vs-gas sales picture in its territory, Consolidated Edison Co. of New York undertook a comparative study of fuel efficiencies. The results of this study, as reported by A. L. Carroll of ConEd at the June meeting of the American Society of Mechanical Engineers in Cincinnati, showed a definite advantage for gas.

The report covered the fuel usage for an entire heating season of 51 residences using domestic fuel oil for heating and of 56 residences using gas. All houses were located in the same general area—Westchester county. Heat loss ranged among these houses from 28,000 to 197,000 Btu per hour.

As the area was, at the time of the survey, being served with manufactured gas but contemplating the conversion to natural (which has since been made), it was considered highly important to have the facts available on the competitive fuels. The significant point to be established in the study was the actual usage of the fuel in the home during the heating season rather than efficiencies determined either in a laboratory or under some artificial controls.

From the final results of the field study, the following basic relationships were determined for the 107 domestic heating and installations tested from which any given set of economic factors can be evaluated:

1. In a normal heating season of 5090 degree days, the gas fuel requirements per 1000 Btu heat loss are:
   2100 cu ft of 1055 Btu natural gas
   or 4123 cu ft of 537 Btu manufactured gas *or 22.14 therms*

2. In the same season the oil fuel requirements per 1000 Btu heat loss are:
   22.5 gals. of 140,000 Btu oil *or 31.5 therms*

3. In terms of equivalent work performed therefore, it can be said that:
   22.14 therms of gas are equivalent to 31.5 therms of oil.

4. As to the relative efficiency of the two fuels, when used in the 107 domestic heating plants tested throughout an entire normal heating season, it can be said that:

   (a) the oil burning equipment in comparison with gas equipment was —

   $$\frac{22.14 \times 100{,}000 \text{ Btu}}{31.5 \times 100{,}000 \text{ Btu}}$$ or 70.3% as efficient

   (b) the oil burning equipment to do an equivalent heating job will require —

   $$\frac{31.5 \times 100{,}000 \text{ Btu}}{22.14 \times 100{,}000 \text{ Btu}}$$ or 142% of the heat units required by gas equipment

   OR 42% MORE

5. This relationship may also be stated as follows:
   (a) 2100 cu ft of natural gas (1055 Btu) is equivalent to 22.5 gal. of oil.
   (b) 4123 cu ft of mfg. gas (537 Btu) is equivalent to 22.5 gal. of oil.
   (c) 100 cu ft of natural gas (1055 Btu) is equivalent to 1.07 gal. of oil.
   (d) 100 cu ft of mfg. gas (537 Btu) is equivalent to .545 gal. of oil.
   (e) 1 gal. of fuel oil is equivalent to 93.3 cu ft natural gas (1055 Btu).
   (f) 1 gal of fue loil is equivalent to 183 cu ft mfg. gas (537 Btu).

NEWS

New Construction

Over $5 Billion Expansion Estimated for 1952-1956

Figures released last month by the American Gas Assn. estimated that the nation's gas distribution and pipeline industry will spend about $5.6 billion for construction of new facilities and expansion of plant in the five-year period, 1952-1956. The previous high record in the gas industry was made in the last five years, when expenditures totaled $5.1 billion. The accompanying table shows the yearly estimate and breakdowns for the various industry branches.

The natural gas branch expects to spend $5,099,000,000 during the period. Expanded transmission facilities are estimated at $3,075,000,000, with $415 million allocated to production facilities and an additional $82 million for underground storage expansion. All other types of gas will account for about $500 million in new construction. Expanded distribution facilities are estimated at $302 million; $150 million will go toward production and storage facilities.

Indications are that there will be a temporary slackening of construction expenditures during 1952 because of continued allocation and material difficulties, but the estimated expenditure of $1.17 billion still represents the third greatest annual expenditure in gas industry history. The record established in 1951 may be broken in 1953 when estimated construction expenditures total $6.681 billion.

In line with the breakdown of expected industry expenditures, the Office of Business Economics, Dept. of Commerce, and the Securities and Exchange Commission, released figures showing that the gas and electric utilities are expecting the largest increases among major industry groups in capital outlays over current rates. In these two categories, expenditures rose from $1045 million in 1946 to $3577 million in 1951. The estimated July-September 1952 figure is $1036 million, just slightly less than the total for the entire year of 1946. A steady increase is also seen in the quarterly breakdowns for 1951 and 1952. For the first quarter in 1951, expenditures totaled $753 million while the 1952 figure was $761 million; in the second quarter, 1951, $893 million compared to $934 million for 1952 (estimated); third quarter figure for 1951 is $933 million while the estimated third quarter figure is $1036 million for 1952.

Financial

Revenue Statistics Released by FPC

A 13.2% increase over April 1951 receipts was shown by natural gas companies reporting to the Federal Power Commission, with operating revenues totaling $161,796,865 in April 1952. For the 12 months ended April 30, 1952, revenues were 19% higher than the previous 12-month period.

Gas utility operating income for the April 1952 period amounted to $28,200,086 (up 6.4%); for the April-to-April period, operating income was $261,606,694, an 11.3% increase over the $235,037,879 for the comparable period in 1951. Net gas utility plant of reporting companies aggregated $4,349,268,071 on April 30, 1952, up $715,303,950. Sales to ultimate consumers during the month were 223,947 MMcf; sales to residential and commercial consumers increased 9.1% and 10.2%, respectively; industrial sales were up 9.4%. Revenues from the three classes of service (residential, commercial, industrial) increased 9.1%, 10.4%, and 11.9%, respectively.

Net income of the companies for April 1952 was $22,271,937, up 3.7% from the April 1951 net of $21,477,426. For the 12 months ended April 1952, net income of $202,356,803 represented an increase of 6% over the April 1951 period.

Laclede To Seek Underground Storage

Possibilities of an end to the conflict between Laclede Gas Co. and Mississippi River Fuel Co. were put forth last month as a result of the proposed $10 million underground storage project proposed by Laclede.

According to William G. Marbury, Mississippi president, his company approves the St. Louis company's storage undertaking and will cooperate in the plan. He said Mississippi "would reconsider the situation" in its fight to gain ownership control of Laclede. However, Mr. Marbury did not announce a change in position.

The reservoir would be in a 25,000-acre tract, most of which would be in St. Louis county, although some of it would extend under the Missouri river into the lowland Missouri Point section of St. Charles county. The exact size, location, and capacity of the storage area will be determined by geological exploration to verify the availability of the storage site. Physical evidence already available has given the company and its geologists strong reason to believe the project is feasible, according to word from Laclede President Robert W. Otto.

Anticipated capacity of the storage is 20

Gas Utility Construction Expenditures, by Type of Gas and by Plant Function, 1951-1956

(Millions)

Type of Gas and Plant Function	Actual 1951	Forecast 1952	1953	1954	1955	1956	Total Forecast 1952-56	Total Actual 1947-51
Natural Gas-Total	$1,363	$1,067	$1,571	$1,206	$645	$610	$5,099	$4,560
Production	124	91	102	72	75	75	415	511
Transmission	867	607	1,133	820	275	240	3,075	2,939
Underground storage	42	40	20	12	5	5	82	a
Other storage	15	5	6	12	10	5	38	a
Distribution	271	279	279	264	255	260	1,337	958
General	44	45	31	26	25	25	152	152
All Other Types of Gas-Total	98	106	110	98	91	91	496	586
Production and storage	19	31	39	29	23	28	150	221
Transmission	6	1	2	2	4	2	11	23
Distribution	66	70	62	61	55	54	302	314
General	7	4	7	6	9	7	33	28
Total Industry-Total	1,461	1,173	1,681	1,304	736	701	5,595	5,146
Production and other storage	158	127	147	113	108	108	603	732
Transmission	873	608	1,135	822	279	242	3,086	2,962
Underground storage	42	40	20	12	5	5	82	a
Distribution	337	349	341	325	310	314	1,639	1,272
General	51	49	38	32	34	32	185	180

a Included in production.

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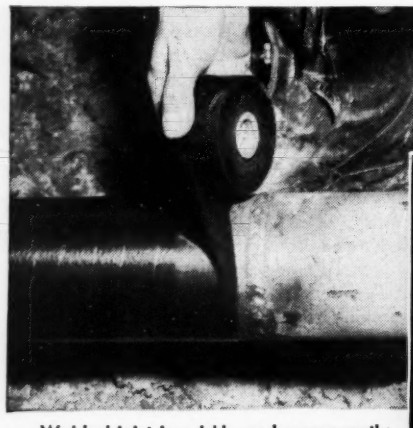

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billion cu ft, which would provide deliverability to serve at least 50,000 more city and suburban house-heating customers. About 10 billion cu ft would be held as a cushion to assure movement of gas out of the sandstone when needed. A year to a year-and-a-half may be required to complete the exploratory phase, and another year or more to complete development.

Development of the reservoir will be under the supervision of Max W. Ball, of Washington, D. C., well known gas and oil consultant.

Earlier Laclede was reported to be considering another source of natural gas in addition to its supply from Mississippi. The existing contract calls for Mississippi to supply all the distributing company's gas needs through 1966 but Laclede feels "it is incumbent upon us to get other sources of gas because up to now Mississippi has not met our requirements."

Gas Sales in First Decline Since 1946

A decline of 4.1% in sales of the gas utility industry to ultimate consumers was shown in May as compared with the same month a year ago. Sales totaled 3578 million therms as against 3730 million sold in May 1951. However, for the 12-month period ended May 31, 1952, sales were 49,637 million therms, a gain of 9.6% over the comparable period last year.

Natural gas sales in May declined to 3316 million therms, or 4.3% under the 3465 million sold in May 1951. This marks the first decline in sales of natural gas since June 1946 and is attributed to declining industrial activities in some sections of the country. Improvement of hydroelectric generating facilities by reason of increased water supply also reduced dependence upon gas for electric generation.

Other figures showed for the 12-month period ended May 31, utility sales of natural gas totaled 46,224 million therms, increasing 10.4% over the comparable cumulative period a year earlier. Sales of manufactured and mixed gas in May were 262 million therms, a 1.2% decrease. For the 12-month period, sales totaled 3413 million therms, a 0.7% decline. Changeovers from manufactured gas distribution to natural or mixed gas, principally in New York and in the New England area, are contributing factors in this decline.

New Increases Asked; FPC Denies Several

The FPC has consolidated into hearings in September two proposed rate increases of Michigan-Wisconsin Pipe Line Co., Detroit. The first increase, totaling about $3,772,000 per year, was suspended in April 1951 and has been in effect under bond since last Oct. 1. The newly suspended $3,871,000 increase would have gone into effect on July 12 if the commission had not acted.

In other actions last month, the FPC disallowed Hope Natural Gas Co.'s proposed $5,236,000 increase in wholesale rates, but accepted a substitute filing amounting to $2,905,000. The rejected raise had been in

Every Automatic Feature

in America's Easiest Ranges to Keep Clean

There's never a let-up in Caloric National Advertising

Caloric national advertising doesn't *start* and *stop;* it keeps right on, month after month, year after year, in national and rural publications. This constant barrage, totalling more than 200 million advertisements each year, has made the Caloric name a household word from coast to coast. It's the range women look for when they start to shop. Give Caloric a choice spot in your floor display—for better sales and bigger profits in 1952.

CALORIC STOVE CORPORATION, TOPTON, PA. • *GAS Ranges Exclusively*

Guaranteed by Good Housekeeping — Replacement or a Refund of Money if Not as Advertised Therein

THAT'S WHY

Ultramatic **Caloric**®

SELLS AND SELLS AND SELLS!

HERE'S

Automatic Cooking

AT ITS FINEST

Just turn on the gas to cook or bake or broil. No matches! No gadgets! No buttons! No waiting.

★ ★ ★

Two big ovens for baking and roasting at different temperatures at the same time.

★ ★ ★

Oven Clock Control for absentee cooking; Automatic 4-Hour Timer to eliminate pot-watching.

★ ★ ★

TriSet Burners for *Fast Boil, Keep Boil* and *Keep Warm* flame, with a thousand and-one in-between heats.

★ ★ ★

And all of these other exclusive Caloric features that women want:

- **Lifetime Burner Guarantee.**
- **Hold-Heat Oven.**
- **Hi-Lo Broiler Pan and Rack.**
- **Non-Tilt Porcelain Oven Racks.**
- **Recessed Oven Light.**
- **Veri-Clean Broiler that lifts out.**
- **Seamless construction.**
- **Porcelain enamel, inside and out.**
- **Triple-coat, acid resisting white parts.**

Caloric®

GAS RANGES

Why Good Pipe Fitters Choose RIDGID 4P Geared Pipe Threader

No. 4P, 2½" to 4" pipe

Extra easy to carry and put on pipe

★ Balanced loop handles—easy to swing 4P where you want it.

★ Mistake-proof workholder sets to size *before* put on pipe—only one set screw.

★ Practically no upkeep—drive pinion in oilless bronze bearing; safe enclosed gear.

★ 4 sets of 5 high-speed steel dies for 2½", 3", 3½", 4" pipe. Ratchet handle; RIDGID Universal Drive Shaft available. Also special 4P for conduit.

★ Buy efficient 4P at your Supply House.

THE RIDGE TOOL COMPANY • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

effect under bond since Feb. 1.

Rejections of proposed increases have also been received by Texas Gas Transmission Corp., Owensboro, Ky., asking $12,480,000, and United Gas Pipe Line Co., Shreveport, seeking a $8,400,000 hike. However, both companies have re-submitted the rate increases, with Texas Gas reducing its amount to $10,555,000. Applications have been denied for rehearings, or reconsiderations, of FPC's order directing Atlantic Seaboard Corp. and Virginia Gas Transmission Corp., both of Charleston, W. Va., to provide "just and reasonable rates."

Among increases requested last month was one by El Paso (Texas) Natural Gas Co. applying for a boost amounting to $15,286,767. Affecting customers in Texas, New Mexico, Arizona, and California, the largest increases would be $7,438,823 jointly to Southern Counties Gas Co. and Southern California Gas Co., both of Los Angeles; and $5,671,985 to Pacific Gas & Electric, San Francisco. In turn, Southern Counties has asked for an increase of $495,120 to be passed on to San Diego (Calif.) Gas & Electric Co. An increase amounting to approximately $6 million a year has been filed by the Peoples Gas Light & Coke Co., Chicago, with the Illinois Commerce Commission.

Oral hearings have been heard in the rate case of Northern Natural Gas Co., Omaha, in which the FPC staff is seeking dismissal in part of a proceeding involving a suspended wholesale natural gas rate increase, amounting to approximately $10.6 million annually.

New Financial Reporting Initiated by AGA

Commencing with the 12 months ended March 31, 1952, the bureau of statistics of the AGA will initiate a new financial reporting service, resulting in the compilation and publication of a composite quarterly income statement for the entire gas distribution and pipeline industry. Designed to help the business and financial community, as well as the gas industry itself, the report will include the most essential items of operating revenues, operating expenses and taxes, and net income.

The initial statement issued shows the total gas industry operating revenues for the 12-month period ended March 31 were $3.130 billion, compared with $3.047 billion in the preceding 12 months, and $2.634 billion for the period ended March 31, 1951, representing an 18.8% gain in revenue over the 1950 period.

The new financial statistics compiled by the AGA refer to the operations of all gas utilities and pipeline companies, differing from the FPC monthly income statements which refer only to that part of the industry subject to the commission's jurisdiction under the Natural Gas Act.

Financial Notes

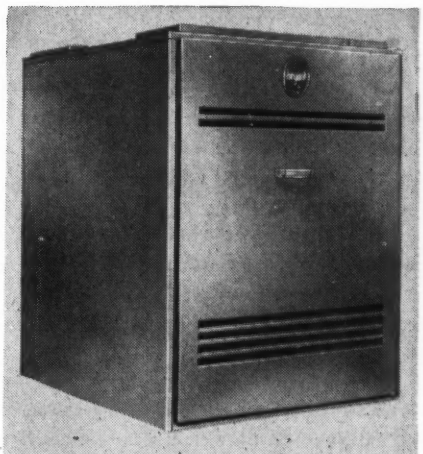
On July 1, closing formalities in the purchase of Palestine (Texas) Light, Heat & Power Co. were to coincide with the beginning of operations of the company by Lone Star Gas Co., Dallas, the purchaser. Lone Star expects to operate the Palestine properties, bought at a cost of approximately

"Customer reaction clinched the No. 1 performance spot for this unit"

says P. V. Cheli,

Bryant, Chicago Branch Manager

It's too easy these days to make *claims* about any product. And it's mighty tempting to cut prices at the expense of quality, too. Personally, I judge *heating* equipment strictly on performance and the reactions I get from my customers. In the case of the Bryant Forced Warm-Air Furnace, customer reaction has certainly proved this unit is the star in its field. Actually this isn't any surprise at all, because the basic engineering and construction that have been put into the Bryant Model 87 have produced advantages that are unsurpassed in any other warm-air unit. Consider, for example, the enviable record for reliability and economical operation that Bryant Controls and Automatic Pilot have built up. And don't forget the Bryant *Hevigage* (12-gauge steel) heat exchanger . . . rugged . . . designed for the fastest and most efficient heat transfer. Almost three times thicker than minimum AGA requirements, too. If you're not already acquainted with the features and performance of this popular Bryant unit why not get a firsthand story from some Bryant customers. Or write Bryant Heater direct for complete information. Bryant Heater Division, Dept. 105, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland, Ohio.



Bryant Model 87
Winter Air Conditioner

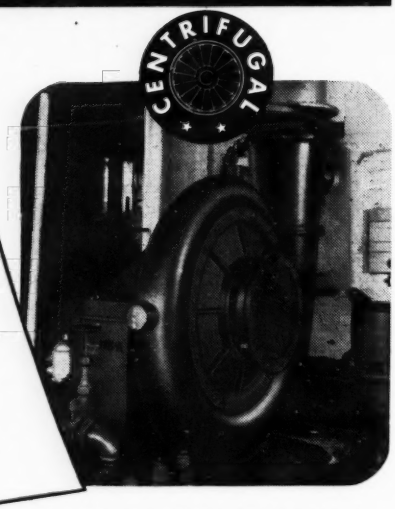
Gas-fired, forced warm-air furnace. Available for all gases. AGA inputs from 60,000 to 375,000 Btu per hour. Has *Hevigage* (12-gauge steel) heat exchanger. Sturdy, compact construction. Handsome gray exterior.

bryant® *best buy*

IN HEATING,
AIR CONDITIONING,
WATER HEATING

No more "*off the cuff*" decisions when you compare blower values

- ☐ Choice of Rotary or Centrifugal
- ☐ Capacity matched to the job
- ☐ Easy accessibility
- ☐ Ruggedness
- ☐ Ease of installation
- ☐ Ability to handle overloads
- ☐ Long-time durability
- ☐ Freedom from breakdowns
- ☐ Low maintenance costs
- ☐ Engineering assistance
- ☐ Proved reputation of maker
- ☐ Customer satisfaction



Type OIB Single-Stage Centrifugal Blower used in manufacturing water gas for southern utility. Driven by steam turbine through flexible coupling. Capacity 12,000 cfm.

If you are considering new equipment for handling gas or air, we suggest you examine the essential values listed above, before you make your final selection. These factors will help you determine the unit that will best match your specific application, and that will give you the most satisfactory, economical performance.

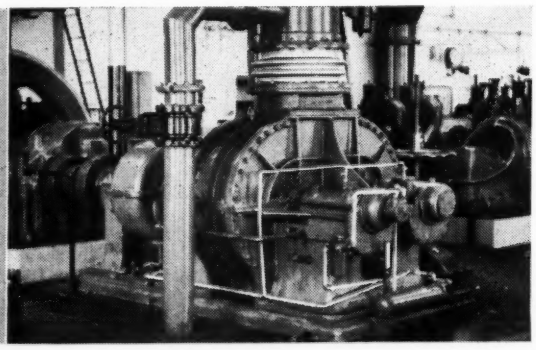
You'll find that R-C equipment rates high in every one of these essential factors. With capacities ranging from 10 cfm to 100,000 cfm or higher, at moderate pressures, and with the exclusive *dual-ability* line of Centrifugal or Rotary Positive types, you have a wide choice to meet the most exacting needs.

If you'd like to tell us about your specific problem, we'll gladly send detailed information for comparison, or supply engineering help from our 98 years of blower building experience.

ROOTS-CONNERSVILLE BLOWER DIVISION
522 Oregon Avenue, Connersville, Indiana

ROTARY

Type RCGH Gas Pump in eastern gas plant. Capacity 6,750 cfm.



REG. U. S. PAT. OFF.
ROOTS-CONNERSVILLE BLOWER
A DIVISION OF DRESSER INDUSTRIES, INC.
BLOWER BUILDERS SINCE 1854

$500,000, with the Palestine Light personnel. Approximately 4200 customers are served in the area.

The biggest gains in buying Texas natural gas, according to railroad commission report, were made by pipelines. During April 367 billion cu ft of gas was sold. Transmission lines took 61% of the total, representing a 15.5% increase over April last year. Interstate pipelines bought 159 billion feet, up nearly 17%. Cycling operations declined 9% and carbon black manufacture from gas was off 23% compared to a year ago.

A plan requiring the liquidation of Standard Gas & Electric Co., New York, and allocation of portfolio securities to all classes of stock has been approved by company directors. The plan is subject to satisfactory tax rulings and appropriate consents from regulatory bodies.

Denison, Texas, has passed a city ordinance on an emergency basis making it a misdemeanor for any utility to charge rates other than those approved by the city. The law provides for a fine of not less than $25 nor more than $200 for such a charge.

Sales and Promotion

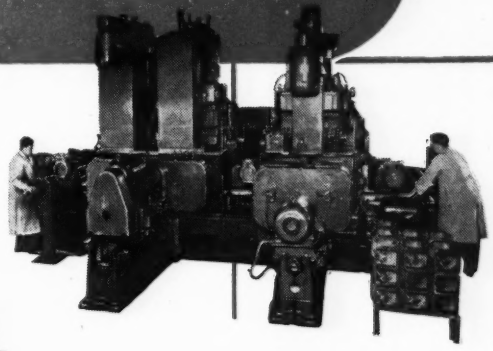
Merchandising Program Launched by Honeywell

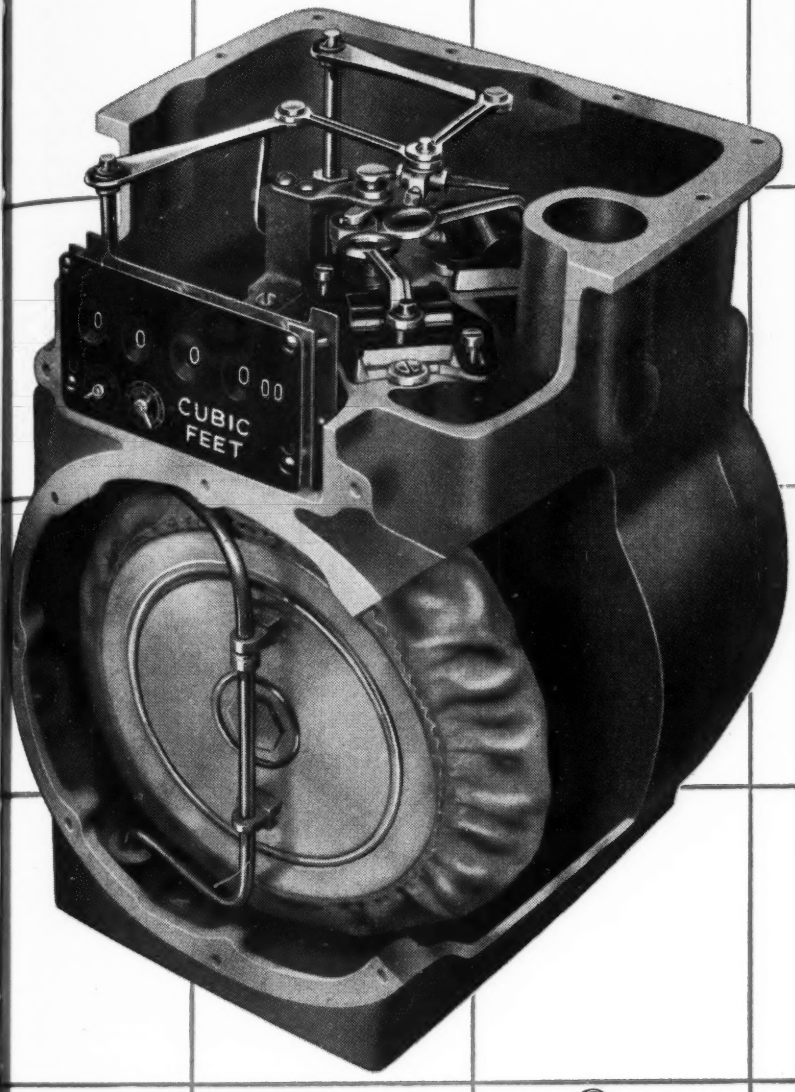
The heart of a $100,000 dealer education program being launched by Minneapolis-Honeywell Regulator Co., Minneapolis, is a series of seven new how-to-do-it books now being made available to the industry. Although the initial use of the plan will be in the heating field, it is applicable to any industry that sells through dealers. The program is expected to have widespread influence throughout the heating industry and has been instigated as a major attack upon the problem of upgrading sales among Honeywell dealers and those of other companies as well.

The books are titled "Making Every Employee A Salesman," covering the subject of personnel from the standpoint of building up an effective selling organization; "Building Business Through Personal Contact," discussing the broad scope of aggressive dealer selling, showing how to uncover sales leads, etc.; "Selling Through Effective Advertising," containing complete information on all types of advertising; "Bringing in the Customers by Mail"; "Putting on a Good Front," emphasizing the impression that exterior appearances make on customers; "Using Displays to Sell"; and "Keeping the Public Sold on You," dealing with public relations.

A little over a year ago, after Honeywell salesmen in its domestic heating division had conducted a series of nationwide meetings and found that the most compelling need in the selling field was for competent salesmanship, and after one of the largest consumer surveys ever made (see *GAS*, Oct. 1951, p. 64), Honeywell decided to make a major attack by building a complete merchandising plan for dealers. The seven books

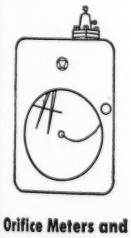
AT LOWEST UNIT COST PER YEAR...



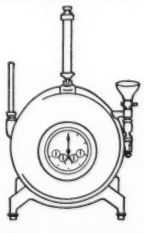


SPECIAL MACHINES AND METHODS

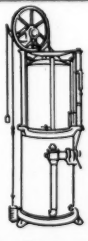
American Meter Company's exclusive Progress-Through machine is one of many American developments designed to combine many separate operations resulting in accuracy in the finished meter unknown before. In this machine, over 100 production tools mill, drill and tap Ironcase meter bodies which are held rigidly in moving fixtures. Accurate positioning of sub-assemblies is assured—each meter body is identically machined relative to precise locating points—each part fits perfectly.



Orifice Meters and Controllers



Wet and Dry Test Meters



Meter Provers and Apparatus

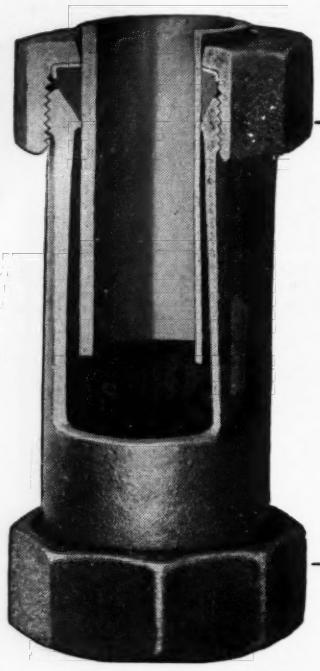
The efficiency and economy of *American* Meters is backed by more than 115 years of experience and by a constant purpose to provide the finest precision instruments known to gas measurement science.

American is and will continue to be the *first name* in metering dependability—always your *first choice* for *"Sustained Accuracy at Lower Cost."*

AMERICAN METER CO EST 1836 MEASUREMENT ENGINEERS

AMERICAN METER COMPANY

INCORPORATED (ESTABLISHED 1836)



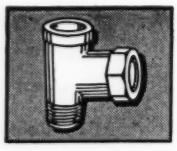
NORMAC

Couplings, Sleeves and Fittings

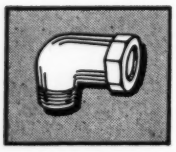
for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

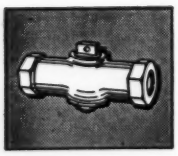
NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.



Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.



Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.



Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

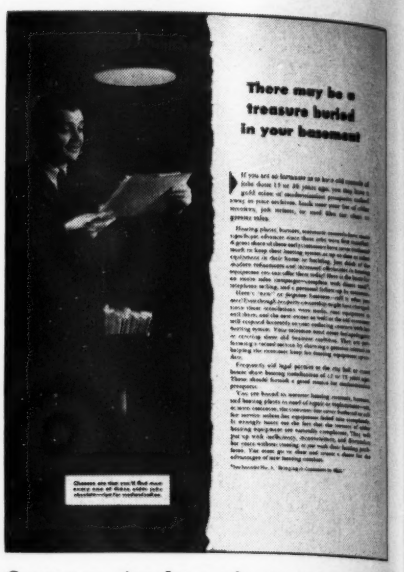
Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

NORTON-McMURRAY MFG. CO.

122 SOUTH MICHIGAN AVENUE - - - CHICAGO 3, ILLINOIS

Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells



Customers ripe for modernization of outdated heating equipment can be found in old files, according to Booklet No. 4, "Bringing in Customers by Mail."

are the result. Easy to read and profusely illustrated, the books not only tell the dealer what to do, but they show him how.

For use in the books, Honeywell designed a symbol (see cut) with the slogan "Automatic Heating—The Servant That Never Sleeps." Suggestions have been made that it become a symbol for the entire automatic heating industry.

Until mid-August, distribution of the books is through Honeywell manufacturers —original equipment customers only. However, after that time distribution on a mass scale will be encouraged through wholesale groups, utilities, and to dealers direct, with the support of the Honeywell field organization and four-color insert advertising in trade publications. Demand has already appeared from dealer training schools and from executives in lines feeling the impact of larger inventories, smaller sales.

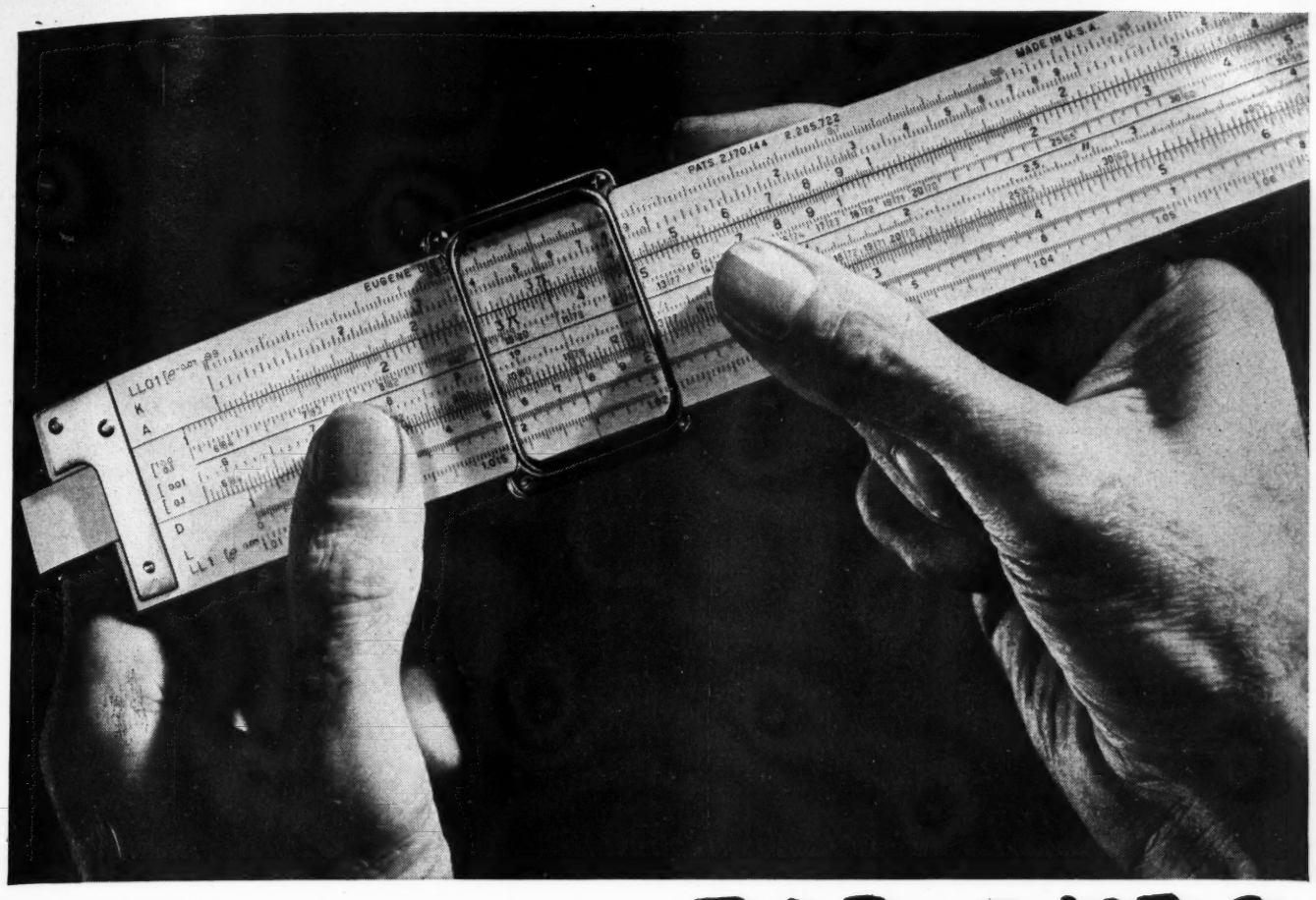
Appliance Trends Revealed By Market Survey

New market figures indicating trends in appliance buying and sales potentialities are contained in a recently compiled equipment study, made by *McCall's* magazine. Eleven hundred fifty-five readers of the four women's service magazines were polled by personal interview.

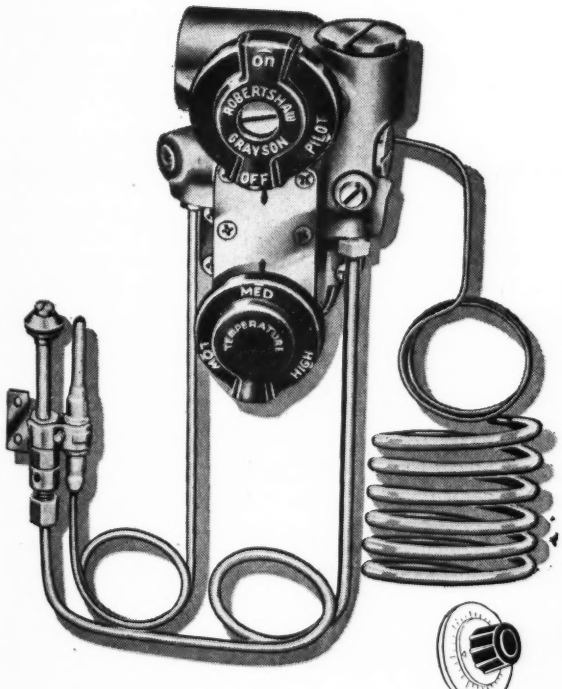
Covered in the report are ownership and buying habits, over a 21-month period, of all the major home appliances, as well as kitchen cabinets, color schemes, and other factors in today's homemaking.

Among base load appliances, the range showed exceptional market possibilities but also a marked trend toward electric models. Age of ranges in use showed the largest group to be in the 3-to-5-year bracket (259) with only slightly less in the 1-to-2-year class (218) and the 6-to-10-year group (249). A quarter of all ranges were bought during 1950 and the first nine months of 1951; the immediate and near future replacement potential was considered to approach 40%.

In replacements, electric models forged ahead: Of 151 ranges bought by the group



How would you check EXPERIENCE?



ROBERTSHAW **UNITROL** GRAYSON

Main gas cock — thermo-magnetic automatic 100% safety pilot control — snap-action-thermostat—pilot adjustment valve — all in one simple unit.

EXPERIENCE is a vital but invisible part of a space heater control. The better this part going into a control, the better the service coming out of it.

To measure the service you'll get out of *Robertshaw-Grayson* UNITROL, you must measure the experience going into it. Here is the formula to use: Take 51 years of manufacturing experience; add the know-how gained from manufacturing millions of identical controls for a single purpose; observe them working under all conditions of operation and service; apply precision manufacturing facilities unmatched in the entire industry.

Do this and you, too, will get the answer to why the overwhelming majority of gas space heater manufacturers prefer *Robertshaw-Grayson* UNITROL above all others.

In Home and Industry, ***EVERYTHING'S UNDER CONTROL***

Robertshaw-Fulton

CONTROLS COMPANY • GREENSBURG, PENNSYLVANIA

Robertshaw Thermostat Division, Youngwood, Pennsylvania • Grayson Controls Division, Lynwood, California • Fulton Sylphon Division, Knoxville, Tennessee • American Thermometer Division, St. Louis, Missouri • Bridgeport, Thermostat Division, Bridgeport, Connecticut

in the 21 months, 87 were electric and 54 gas, the remainder other fuels. Fuels in use prior to replacement had been, for gas, 99; electricity, 29; oil, 16; coal, 7. The bulk (29.1%) of replacements were in the 6-10-year age group; 26.4% were in the 11-15-year group. Reasons for replacement varied, but 25.9% wanted more modern (automatic) models, 20.3% wanted to change to electric. Only 17% were worn out and only 6% had specific faults.

In the refrigerator field, the majority of boxes are replaced within the first 15 years of their life. More than 26% of models in use were 3 to 5 years old; 19.3% were 6 to 10 years, 19.8% were 1 to 2 years. Of 163 replaced, 148 were electric (replaced by 142 electric and 6 gas), 13 were gas (replaced by 10 electric and 3 gas). Of these trade-ins, 63.2% were between the ages of 6 and 15 years. Sixty percent were replaced for reasons other than age or condition.

In the water heater classification, identification of brand name was very low. Only 51 replacements were made in the 21 months; of those replaced, 6 were electric, 38 gas, and of the new models which replaced them, 30 were gas and 20 electricity. Age of replacements fell mostly in the 11-to-15-year group (51%) and the 6-to-10 group (21.6%).

Spring Style Show Successful in Northwest

Over 3000 women attended three performances of the annual spring style show of gas ranges presented by Portland (Ore.) Gas & Coke Co. and one of Portland's exclusive women's shops. The two firms collaborated in presenting the show in three of the city's largest neighborhood theaters and auditoriums, with Mrs. Rita Calhoun, Gasco's home service director, leading the range part of the style show with a cooking demonstration.

Every means of promoting the show was used. Invitations were sent to 75 women's organizations, advertisements and news stories appeared in metropolitan newspapers and neighborhood shoppers, and placards were distributed to business houses in the area where the program was scheduled that week. Mrs. Calhoun appeared on homemaking radio programs, and spot commercials were timed to catch the greatest number of women listeners.

Over 3000 Portland women saw the spring style show featuring fashions in cookery and clothes co-sponsored by Portland Coke and a Portland women's shop.

During the show Mrs. Calhoun, in her presentation "Food Is Fun," prepared an oven dinner for eight while giving out tips for easier and more enjoyable cookery. Seven gas ranges were used for her demonstration. Numerous prizes were given away—including the dinner for eight—at each performance. Neighborhood appliance dealers and merchants, as well as gas appliance representatives, cooperated by donating prizes. At each show 10 of the latest style spring hats were given away by the sponsoring companies. In addition, the women were told that with the purchase of a new range during the campaign a hat would be presented the purchaser.

Appliance Division Formed By Honolulu Gas

R. B. Craddock

The re-entry of the Honolulu Gas Co. Ltd. into direct appliance selling has been announced by A. E. Englebright, vice president and general manager of the Hawaiian firm. The Honolulu Gas Equipment Co. will be a non-utility division engaged in distribution and merchandising of gas appliances throughout the Territory of Hawaii. R. B. Craddock, assistant general manager of the gas company, will assume responsibility for the over-all operation of the new division, in addition to his present duties.

For the past two years an affiliated company, Pacific Refiners Ltd., had been the appliance outlet. In addition to domestic appliances, Honolulu Gas Equipment is taking over the distribution of commercial appliances and industrial gas-fired equipment.

Unit Shipments Up For Ranges and Water Heaters

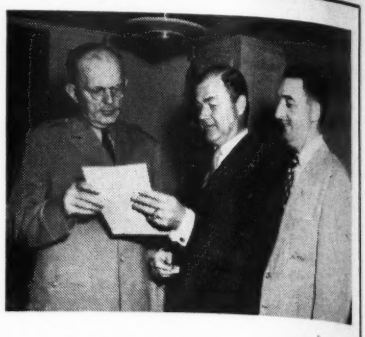
For the first time in more than a year, shipments of gas ranges and water heaters showed signs of climbing up out of the doldrums in June by recording sharp gains over the volume for the corresponding month in 1951.

Even brighter news was the unseasonal gain made in range shipments over the previous month's totals. Units totaled 178,900, almost 1800 more than in May and 50,400 better than June 1951, when the post-Korea boom's recession had touched bottom. Percentage-wise, the gain over 1951 was 39.2%.

The showing made in June also helped pull up the average for the second quarter, total shipments ending up only 1.7% behind last year's as compared with a 35.7% drop in the first quarter. For the first half-year, the total was 22.1% short of 1951—1,039,800 against 1,335,700.

Figures for electric range shipments, available through May only, showed that the gas models were making a faster recovery than their electric counterparts. In that month, electric shipments dropped 34.4% from the 1951 month, while gas ranges were only 9.4% behind, and the sales ratio, gas-to-electric, was an even 2-to-1 against last year's 1.5-to-1.

Gas water heaters in June hit 153,100, 21,600 (16.4%) ahead of last year. For the quarter, they lagged by 6.5%; for the half-year, 21.3% (913,500 against 1,160,600). Ratio of gas-to-electric in May was the highest since January—2.8-to-1, electric model shipments in that month having dropped 35.6% as against 4.8% for gas.



Voluntary Refund

Examining a contract modification resulting from a voluntary refund of $175,000 made to the government by McCabe-Powers Auto Body Co., St. Louis, are (left to right) Brig. Gen. W. Preston Corderman, Commanding General, Signal Corps supply agency, Philadelphia; John J. Powers, McCabe-Powers chairman; and Edward T. Kennedy, eastern representative, McCabe-Powers. The completion of the contract, covering line construction and general maintenance bodies, and the savings resulting, were partly responsible for the awarding of an additional contract calling for something in excess of 1200 units.

Summer-Long Promotion In Pittsburgh Park

On Labor Day one of the 1,700,000 people who have visited West View park in Pittsburgh during the summer will be the lucky winner of an all-gas model home complete with a Universal gas range, Servel refrigerator, Hamilton gas clothes dryer, Calcinator gas incinerator, and an American-Standard furnace and water heater.

The award will be the climax of a summer-long promotion originated by the publicity director of the park and carried through to completion by John A. Lammert, special representative of the Peoples Natural Gas Co. Sharing in the show are the Natural Gas companies of Pittsburgh, including Equitable, Manufacturers Light & Heat, T. W. Phillips, and Peoples; Admiral Homes Inc., donor of the home; and a number of dealers and gas appliance manufacturers.

A park visitor receives a free chance on the house for every dollar's worth of tickets bought at the park concessions. A booth adjacent to the model home features a gas range exhibit; in addition, a weekly gas cooking school is held. Lucky ticket holders are eligible to take home a new gas range from the school and it is estimated that by the end of the season $4000 in gas ranges will have been parceled out.

CALENDAR

AUGUST

12th Annual Appalachian Gas Measurement Short Course—University of West Virginia, Morgantown, Aug. 25-27.

SEPTEMBER

Pacific Coast Gas Assn. Annual Meeting—Ambassador hotel, Los Angeles, Sept. 3-5.

Wisconsin Utilities Assn. Management Conference—Museum of Science and Industry, Chicago, Sept. 7-9.

ASA Third National Standardization Conference—Museum of Science & Industry, Chicago, Sept. 8-10.

Mid-West Gas Assn. 29th Gas School and Conference—Hotel Sheldon-Munn and Iowa State College, Ames, Iowa, Sept. 11-12.

New Jersey Gas Assn. Annual Meeting—Monmouth hotel, Spring Lake, N. J., Sept. 12.

OCTOBER

Wisconsin Utilities Assn. Technical and Sales Section Convention—Schroeder hotel, Milwaukee, Oct. 1-3.

Independent Natural Gas Assn. of America Annual Meeting — Fontenelle hotel, Omaha, Neb., Oct. 6.

Pacific Coast Regional Restaurant Convention and Exposition—Biltmore hotel, Los Angeles, Oct. 7-9.

California Natural Gasoline Assn. Fall Meeting—Ambassador hotel, Los Angeles, Oct. 10-11.

40th National Safety Congress & Exposition of the National Safety Council—Chicago, Oct. 20-24.

American Gas Assn. Annual Convention—Atlantic City, N. J., Oct. 27-30.

GAMA Exposition—Atlantic City, N. J., Oct. 27-31.

NOVEMBER

American Petroleum Institute Annual Meeting—Chicago, Nov. 10-13.

American Standards Assn.—Waldorf-Astoria, New York City, Nov. 19.

Mid-Southeasten Gas Assn.—The Sir Walter hotel, Raleigh, N. C., Nov. 20-21.

American Society of Mechanical Engineers—Hotel Statler, New York, Nov. 30-Dec. 5.

JANUARY 1953

Pipe Line Contractors Assn. Annual Convention & Exhibition — Shamrock hotel, Houston, Jan. 19-21.

FEBRUARY

AGA Home Service Workshop — Baker hotel, Dallas, Feb. 2-4.

MARCH

National Association of Corrosion Engineers—Hotel Sherman, Chicago, March 16-20.

New England Gas Assn.—Hotel Statler, Boston, March 26-27.

Mid-West Regional Gas Sales Conference—Edgewater Beach hotel, Chicago, March 27-29.

Midwest Gas Assn. Annual Convention — Broadmoor hotel, Colorado Springs, Colo., March 30-April 1.

APRIL

AGA Distribution, Motor Vehicles and Corrosion Conference—Hotel Sherman, Chicago, April 12-16.

National Conference of Electric & Gas Utility Accountants—Hotel Sherman, Chicago, April 20-22.

Southwestern Gas Measurement Short Course—University of Oklahoma, Norman, April 21-23.

Indiana Gas Assn. Annual Convention—French Lick Springs Hotel, French Lick, Ind. (Tentative) April 23-24.

Regulation

Strict Penalty for Misuse Rejected by Missouri PSC

While rejecting a $200 a month penalty proposed by the St. Joseph (Mo.) Light & Power Co. for natural gas customers in Maryville, Mo. who use gas for heating without company consent, the Missouri Public Service Commission last month substituted a service rule allowing the company to disconnect gas service to such customers. In approving the new service limitation rules, the commission held the proposed $200 penalty was excessive and could not be enforced.

The approved rules permit St. Joseph Light to supply gas for heating purposes to Maryville customers who had such service prior to 1952, plus 120 heating customers to be added this year.

The company's proposal came about after the Michigan-Wisconsin Pipeline Co., St. Joseph's supplier, received FPC approval of a limitation on gas to be furnished for heating purposes.

Oklahoma Governor Charges "Legalized Waste"

Calling the state corporation commission "derelict" in enforcement of the law and its own rules, Governor Murray of Oklahoma charged last month that the commission has "virtually legalized" the waste of natural gas in the state. The practice of the commission is permitting high gas-oil ratios, although, he states, the commission's engineers knew that such orders would increase the flaring of gas and hasten the depletion of the oil reservoir.

The governor said that the commission "has failed to curb the venting or flaring of natural gas in the oil fields, but has instead granted higher gas-oil ratios to fields which had no or insufficient facilities to handle the gas, and thus has virtually legalized the waste . . ." He brought out the fact that the commission has heard industry applications seeking to reduce the amount of gas being produced with the oil and has granted the high gas-oil ratio applications when there was no opposition. However, the greatest advancement in conservation in recent years has been made by the oil companies, cooperating with the gas industry, in constructing natural gasoline and compressor plants in recently discovered fields.

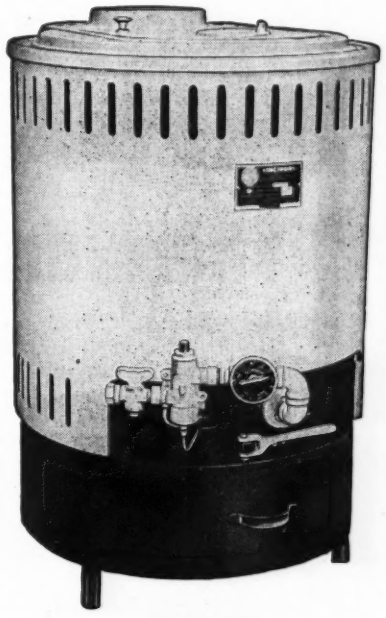
Adjustment Clause for NOPSI Rate Schedule

Gas rates charged to consumers by New Orleans (La.) Public Service Inc. shall in the future be increased or decreased by exactly the amount of the increase or decrease in the price paid by NOPSI at city gate, in line with an ordinance adopted by the New Orleans city council. Utilities Commissioner A. Brown Moore called it an "automatic adjustment clause" to be inserted in the NOPSI rate schedule and said that "all this does is prevent Public Service from doing anything more than adding or deducting the increase or decrease."

The price per thousand at city gate paid by NOPSI is fixed by the Louisiana Public Service Commission.

TO INSURE CUSTOMER SATISFACTION SELL...

AUTOMATIC Incinor
TRADE MARK REG U S PAT OFF
the gas-fired incinerator



MODEL S-25
AUTOMATIC
2-bu. capacity home unit

It's a "MUST" with automatic heat

Builders say, "it's just common sense to include Incinor — the modern way to dispose of wet or dry garbage and combustible trash."

Owners, by the thousands, say Incinor is indispensable—makes housekeeping easier.

Incinor's attractive finish fits into basement or utility room—and it's easy to install—easy to operate. Setting the clock turns on gas which is automatically turned off at end of burning time.

A.G.A. APPROVED
Approved by A.G.A. for use with natural, manufactured or mixed gases, or liquefied petroleum gases.

4-bu. commercial units also available.

Write TODAY for catalog and price schedule!

INCINERATION DIVISION
BOWSER, INC.
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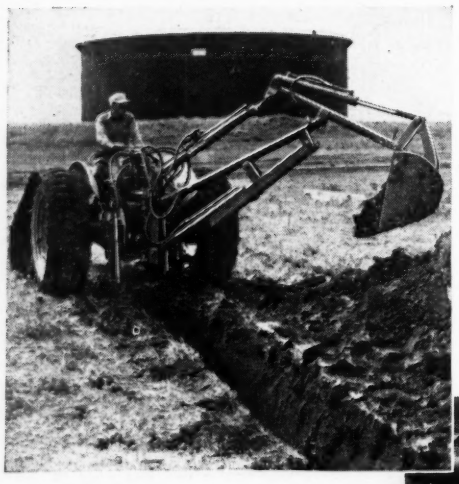
Panhandle Eastern to Serve Industrial Users Direct

Five decisions have been filed by the FPC authorizing Panhandle Eastern Pipe Line Co., Kansas City, Mo., to deliver natural gas direct for industrial purposes on either an interruptible or dump basis to consumers in Missouri, Illinois, Indiana, and Ohio. If no review of the decisions is initiated during a 30-day period, sales would be authorized to the Northeast Missouri Electric Power Cooperative, Marion county, Mo.; Glass Fibers Inc. and General Motors Corp., Defiance, Ohio; the city of Jacksonville, Ill.; Alsey (Ill.) Brick & Tile Co.; and Clay City Products Co., near Montezuma and Mecca, Ind.

Following closely on the issuance of the above authority, the FPC denied a Panhandle Eastern request for a 37.5 MMcf per day reduction in natural gas deliveries to Michigan Consolidated Gas Co., Detroit. In denying the request, which would reduce deliveries from 125 MMcf to 87.5 MMcf daily, the FPC noted that Panhandle had adequate supplies and pipeline capacity to continue its present delivery, and stressed that the move would tax Michigan-Wisconsin Pipe Line Co., Michigan Consolidated's other supplier. The commission stated that while the requisite volume of gas to make up for the firm deficiency could be manufactured, the added cost upon companies and consumers involved would be "contrary to the public convenience and necessity."

UNCOVER PIPELINE FASTER, CHEAPER with the Sherman Power Digger



For pipeline maintenance in any terrain—leak repairs, service taps, anode installations and so on—this sturdy, compact hydraulic digger uncovers pipeline faster, at lower cost. Fitted to a light, rubber-tired tractor, it works where other equipment is impractical. Travels quickly from job to job. Cost-cutting performance proved in thousands of applications.

The Sherman Power Digger swings in 140° arc. Reaches 8 feet below grade. Precise finger tip control. Digs mud, hardpan, gravel, shale, and stony ground.

•

Get all the facts on the Sherman Power Digger. Write today for descriptive bulletin J1.

Designed, Engineered and Manufactured Jointly by

SHERMAN PRODUCTS, Inc.
Royal Oak, Michigan

WAIN-ROY CORP.
Hubbardston, Mass.

Patent No. 2,303,825. Other patents pending.

Sherman
PRODUCTS, INC.
ROYAL OAK, MICHIGAN
Sherman SP Products

New York PSC Starts Safety Investigation

An investigation of safety provisions used by utilities in the transmission of gas was started last month by the New York PSC. The probe, resulting from the Brighton, N. Y. explosions in 1951, will be presided over by PSC chairman, Benjamin F. Feinberg, who said that "in view of the seriousness ... and the importance of remedial measures taken in that case and the further fact that the engineering judgment as to the most modern safety measures varies with different companies, the commission will seek to determine what additional safeguards are necessary to protect the consuming public."

The PSC had summoned 44 gas companies serving approximately 3,700,000 homes, business and industries in the state to the first hearing in Albany.

OPS Retains Authority

Authority to intervene in rate increase cases before the FPC under provisions of the Defense Production Act, as amended by Congress last month, was retained by the Office of Price Stabilization.

As the bill amending the Defense Production Act, which became law June 30, was passed by the House, it took from the OPS the right to intervene. However, the Senate version of the bill continued the authority and disapproved the House action. Therefore, as the amendment became law, intervention authority was retained by the OPS.

Regulatory Newsnotes

Permission to restrict use of gas for space heating next winter has been asked by Western Kentucky Natural Gas Co., Owensboro. In filing its plea with the Kentucky PSC, Western Kentucky cited the shortage of 1649 Mcf of gas on the coldest day last winter and the expected 7969 Mcf shortage this coming winter. The proposed restrictions are aimed principally at large residences, apartment houses, commercial buildings, and factories.

New York State Electric & Gas Corp. has public service commission authority to connect 1000 additional gas space heaters in the company's Elmira, N. Y. district. The company originally requested permission to extend service to 1500 homes.

Miscellany

House-Heating Customers Offered Budget Plan

Recognizing the fact that normally over 50% of the entire year's heating cost comes during December, January, and February, the Portland (Ore.) Gas & Coke Co. has a new budget plan for leveling off winter heating bills by means of "credit" built up during the summer and early fall.

Customer response has been enthusiastic, reports Paul F. Leary, superintendent of Gasco's customers office. Figures show that over 1350 house heating customers requested the budget plan during the first month following mailing of an explanatory folder.

Time never runs out...

Research engineering is continuous and never-ending, with the Milwaukee Gas Specialty Co. It's a program of progressive change—to improve present MGSCo products—to test and perfect their performance in practical applications. But even more important—to correctly *anticipate* your *future needs* and intelligently interpret them in the development of new and revolutionary products. This will mean new help to you—as a user of industrial or domestic gas appliances—or as a manufacturer in the bettering of your gas appliances. Time never runs out on Milwaukee Gas Specialty Co. Always a pace ahead in new product development!

BASO
IGNITION SYSTEMS
for 100% shut off

Baso Safety Pilots, with *Annulair* Pilot Burners, provide safe, reliable, positive, service-free ignition systems for water heaters, space heaters, clothes dryers, deep fat fryers, and other applications up to 35000 BTU with manufactured gas. Send for Bulletin SC-300-32

MILWAUKEE GAS SPECIALTY CO., MILWAUKEE 1, WISCONSIN

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ANOTHER HAYS FIRST
STANDARD PACKAGES
OF IRON BODY
GAS SERVICE STOPS

FEMALE IRON PIPE ENDS

SIZE	¾"	1"	1¼"	1½"	2"
PIECES PER CARTON	25	20	15	10	6
CATALOG NUMBERS — APPROXIMATE GROSS WEIGHTS OF CARTONS					
7400	45	55	60	60	55
7405	45	55	60	60	55
7420	50	60	65	65	55
7425	50	60	65	65	55
7430	50	60	65	65	55
7435	50	60	65	65	55
7440	50	60	65	65	60
7445	50	60	65	65	60
7482	45	55	60	60	55
7484	45	55	60	60	55
7486	50	60	65	65	55
7488	50	60	65	65	55
7490	50	60	65	65	55
7492	50	60	65	65	55

THREADLESS COUPLING ENDS

SIZE	¾"	1"	1¼"	1½"	2"
PIECES	18	12	8	6	4
7500 to 7545	55	55	50	55	55

HAYS GAS SERVICE PRODUCTS
HAYS MANUFACTURING CO.
ERIE, PA.

The plan works in this way: During the first five months when heating costs are at the very lowest, budgeted amounts are added to monthly gas bills. During the five coldest months, when heating costs are normally higher, budgeted amounts are subtracted from the customer's bill.

Studies made under the new budget plan snow very few instances where the highest bill of the year is more than 3% above the average bill during the entire year. Mr. Leary feels that this will aid materially in eliminating many high-bill complaints during winter months. It is also believed that the number of delinquent bills and partial payments during the peak months will be materially reduced.

Frank Enright Joins GAS Staff in Cleveland

Frank Enright

Frank J. Enright, well known advertising man in the Midwest, has joined the Jenkins Publication staff as Cleveland district manager. The magazines under his supervision will include GAS, BUTANE-PROPANE *News*, and Western Metals, as well as the technical books for these industries. He will headquarter in the publications' Cleveland, Ohio office at 1836 Euclid Ave.

Mr. Enright is a member of the Cleveland advertising club and the Pittsburgh Industrial Advertising Council, and a director of the Industrial Marketers of Cleveland. He is a past president of the TF Club of Cleveland.

Assisting Mr. Enright will be Joseph R. Geryk, formerly assistant to the promotion and sales managers of Platt Publications, Cleveland, and an account representative in the Management Controls Div. of Remington Rand Inc., Cleveland and Akron. Mr. Geryk is a University of Michigan graduate and served in the army air corps during World War II.

23 Repair Shops To Be Replaced by One

Testing and repairing of gas meters, now done in 23 district gas meter shops located throughout the state, will be centralized by the Public Service Electric & Gas Co., Newark, N.J., in one shop to be located in Springfield. To be designed specifically for meter service, the new shop will permit large volume operations at a central location with specialized equipment.

Shipment of meters from the plant to districts will be on trailer trucks equipped with specially designed meter hand trucks which will provide rolling storage for both the districts and state meter shops. Manual meter handling will be eliminated largely by the use of both carrier type and moving belt type conveyors. Special facilities will be available for heavy industrial meter handling. The diaphragm department will have an automatic tying machine and a motorized storage rack. Other facilities in the one-story,

EMPIRE *Gas*

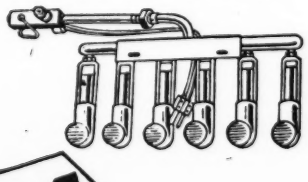
FLOOR FURNACES

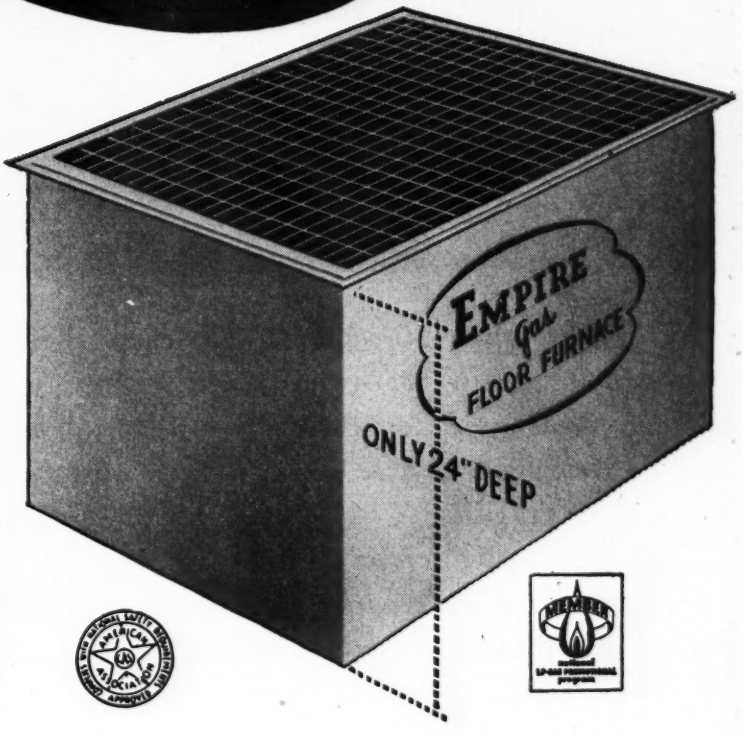
WILL

- **INCREASE YOUR SALES**
- **SATISFY YOUR CUSTOMERS**
- **INCREASE YOUR PROFITS**

EXCLUSIVE WITH EMPIRE

***The* FAMED "Thriftmatic" *Gas* BURNER**





But, no Magic is necessary to sell EMPIRE GAS FLOOR FURNACES.

A GOOD NAME and a GOOD PRODUCT will always sell.

See your local EMPIRE REPRESENTATIVE or write direct to

EMPIRE

STOVE COMPANY

BELLEVILLE, ILLINOIS

WORLD'S LARGEST MANUFACTURER OF *Gas* FLOOR FURNACES

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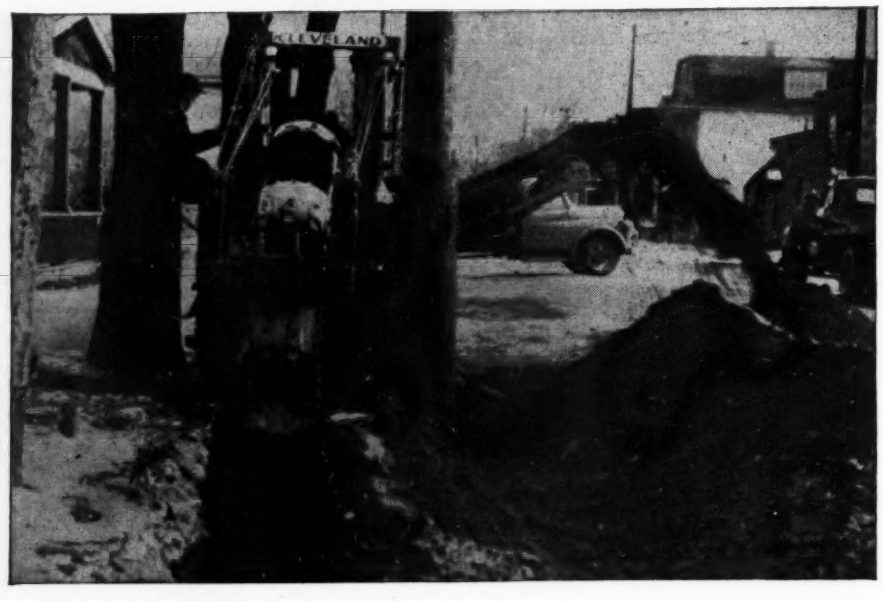
CLEVELAND Baby Diggers

PERFORMANCE PROVED THROUGH 30 YEARS



● More than 30 years of close engineering cooperation with users have built for CLEVELANDS a record of *proved performance* in the specialized field of utilities line trenching operations. CLEVELANDS have earned this reputation by delivering maximum trench production for every operating dollar—no matter how tight the spot, the schedule or the budget.

★ ★ ★

The BABY DIGGER profitably performs your three jobs—mains, extensions and services . . . gets *to* the job fast and safely by truck and trailer . . . *does* the job when it arrives, regardless of soil or terrain. That's why utilities and contractors for years have standardized on dependable CLEVELAND BABY DIGGERS.

Get the Full CLEVELAND Story from Your Local Distributor

Pioneer of the Modern Trencher

THE CLEVELAND TRENCHER CO.

20100 ST. CLAIR AVENUE • CLEVELAND 17, OHIO

80,000 sq ft building will include an instrument repair room, regulator repair room, parts tinning apparatus, and maintenance and sheet metal shops.

Gasair Equipment Made Exclusively by Binn's

Edward J. Pagendarm, president of Binn's Machine & Tool Works, San Francisco, has announced that his company will continue to be the exclusive manufacturer of all Gasair equipment.

A second organization—Gasair Associates—also headed by Mr. Pagendarm, with Willis S. Yard as vice president, is the exclusive selling agent for Gasair units.

Some of the firms now franchised to sell Gasair units include American Liquid Gas Corp. in southern California, Butane Gas & Appliance Co. in the Midwest, Drake & Townsend Inc. and Pacific Gas Corp. in the East.

The construction of new factory and office facilities at Redwood City, just south of San Francisco, will begin immediately, according to Mr. Pagendarm. The plant will cover 25,000 sq ft and will feature the latest in modern production machinery. Completion of the plant is scheduled for early fall.

Union Carbide Plans Move

A move to Westchester county, N. Y. of its principal offices from four office buildings in the Grand Central Terminal area of New York City is contemplated by Union Carbide & Carbon Corp., according to President Morse G. Dial. The move, involving a 286-acre site in the towns of Greenburgh and Mount Pleasant, was awaiting the expected approval of the two towns involved to a change in zoning restrictions from residential to business uses.

Union Carbide, with 2500 employees in New York, has given no reason for the move.

New Universal Distributor

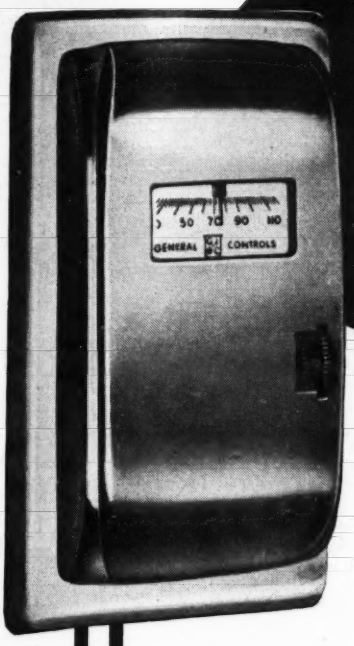
Offices, showrooms, and warehouse facilities have been established in Los Angeles by the newly organized T. H. Hall Co., southern California representatives of Cribben & Sexton Co., Chicago.

Principles of the company are Tom Hall, formerly division manager of the Geo. D. Roper Corp.; M. A. Klein, formerly with Roper and the Southern California Gas Co.; and T. C. Hall, who had been with Roper since his release from the navy following World War II.

Sales Conference Held

The home office in Tulsa was the scene of the recent annual sales conference of field sales, branch, and district managers and service personnel of National Tank Co. Divided into two separate meetings, representatives from National's 41 domestic and Canadian branches participated in the meeting.

Conducting the meetings were Jay P. Waler, president; Cecil Wells, executive vice president; and Clarence Glascow, vice president and chief engineer.



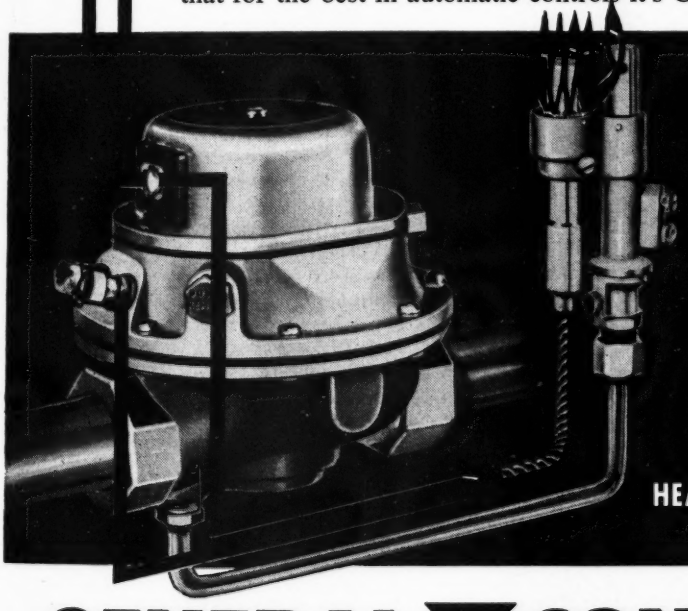
"FIRST"

BX-69

GAS HEATING PACKAGE SET

the original self-generating all gas control system

BX-69 is a variation of a famous gas industry "First," the sensational B-60 All Gas Control System *originated and developed by General Controls.* Remote thermostatic control of the system is provided, *yet no outside electrical current is required.* Positive safety shut-off, completely safe low voltage wiring, accurate temperature control, silent operation combine in the BX-69 to make it the best control system for gas-fired heating appliances. A General Controls "First," the BX-69 is just another reason why we can say with confidence that for the best in automatic controls it's General Controls.



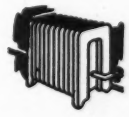
SILENT
ACCURATE
LOW COST
AUTOMATIC
CONTROL
FOR ALL
GAS-FIRED
HEATING APPLIANCES

CIRCULATORS — BX-69 is easily adaptable for remote control of circulators.

CENTRAL WARM AIR HEATING — Quiet operation for central or blower furnaces.

FLOOR FURNACES — Provides quiet operation, remote control for floor furnaces.

GAS RANGES — Desirable for gas ranges equipped with heaters.



GAS RADIATORS — Readily controlled by BX-69.

WALL HEATERS — BX-69 is easily installed in wall heaters.

GAS FIRED BOILERS — Simplicity and lower cost recommends BX-69.

COMMERCIAL & INDUSTRIAL OVENS — BX-69 is ideal where external electric circuits not provided or desired.

GENERAL CONTROLS

801 Allen Avenue Glendale 1, Calif.

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls

FACTORY BRANCHES: Baltimore 5, Birmingham 3, Boston 16, Buffalo 3, Chicago 5, Cleveland 15, Columbus 15, Dallas 2, Denver 4, Detroit 21, El Paso, Glendale 1, Hartford, Houston 6, Indianapolis 4; Kansas City 2, Milwaukee 3, Minneapolis 2, Newark 6, New Orleans 16, New York 17, Omaha 2, Philadelphia 23, Pittsburgh 22, Sacramento 14, St. Louis 3, San Francisco 7, Seattle 9, Toronto (Canada), Tulsa 6, Washington 6.

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Safety Award for Peoples

Receipt of the award of honor, presented recently by the National Safety Council, marked the second major safety honor won by the Peoples Natural Gas Co. this year. Leo Nuhfer, safety director for the Pittsburgh company, said that the award, the highest recognition given by the council, is presented on an industry-wide basis to firms having the best percentage reductions in their accident frequency and severity rates. Peoples had achieved a 96% better-than-par rating in terms of severity, and an 88% better-than-par rating in terms of frequency.

In March, Peoples won first place among 20 major competing gas companies for its 1951 safety record.

News Notes

For the second year in succession, publications of American Radiator & Standard Sanitary Corp., Pittsburgh, took honors in the product literature competition co-sponsored by the American Institute of Architects and the Producers' Council Inc. The only certificate of exceptional merit among the 129 entries went to the catalog, "American-Standard Warm Air Heating," placing first in the Class II division. A Class II certificate of merit also was awarded "Ratings Data and Dimensions."

Bryant Equipment Corp., West Haven, Conn., has been named distributor for Bryant Heater Division, Affiliated Gas Equipment Inc., in the state of Connecticut and for Westchester and Putnam counties in New York. M. H. Laundon Jr., formerly Bryant's New York branch manager, is president of the new distributorship and W. H. Frank is vice president. Malcolm McLean now heads Bryant's New York branch operation.

Next month the industrial water heater division of A. O. Smith Corp., now located in Toledo, will be transferred to Kankakee, Ill. The move, involving production equipment and some personnel, is being made to coordinate production with the company's sales division that handles both industrial and domestic water heater distribution.

A Hartford, Conn. branch of General Controls Co. was opened early last month. Joe Crandley, formerly manager of the firm's Baltimore office and newly named district manager of the Hartford branch, will also direct operations of General Controls' Massachusetts subsidiary, Automatic Controls Co. Frank Murray heads the Boston office.

Now handling advertising for the home appliance division of the Hamilton Manufacturing Co., Two Rivers, Wis., is the Richard H. Brady Co. Inc. of Stevens Point, Wis. For the past three years, the Brady company has been advertising counsel on the company's six other divisions.

MAXITROL NOW FILLS INDUSTRIAL HEATING VOID

Before gas can be used on industrial equipment, its pressure must be reduced from some higher supply pressure. Regulation of low pressures (below 1 psi.) can be easily accomplished with one of many ordinary low pressure regulators. High pressures (above 5 psi.) can be effectively controlled by selecting from several brands of high pressure or service regulators.

None of these types is suitable for handling intermediate pressures (between 1 psi. and 5 psi.). The former cease to function properly and the latter will not allow sufficient gas to flow.

At both *low* and *intermediate* pressures, only MAXITROL will handle massive volumes of gas and still maintain accurate, sensitive regulation.

Will this superior control help you solve a troublesome problem?

Maxitrol IS BEST, BY FAR!

REG. U. S. PAT. OFF

DETROIT REGULATOR CO.

1742 RIVARD STREET DETROIT 7, MICHIGAN

Sold on the Pacific Coast by: PACIFIC SCIENTIFIC COMPANY
San Francisco, Los Angeles, Seattle, Portland

PEOPLE

JOSEPH SODOMA, assistant to the president and general manager, and first assistant secretary of Southern Counties Gas Co., Los Angeles, retired last month after more than 30 years with the company. During his entire career with Southern Counties, Mr. Sodoma served in President A. F. Bridge's office, first as assistant to Mr. Bridge when he was rate engineer, and last in the above positions at his retirement.

M. C. Albrittain

Recent organizational changes at Consolidated Gas Electric Light & Power Co. of Baltimore (Md.) include the elevation of MASON C. ALBRITTAIN to the post of general sales manager. Other advancements made were: CLIFFORD C. BARNES, manager, appliance sales department; HAROLD F. CARR, manager, residential sales promotion department; ROBERT E. SCHMELLENKAMP JR., manager extension department; and WALTER H. VOLKER, superintendent, electric appliance service department.

T. R. RAGLAND JR. has become manager of the new gas procurement department of Carbide & Carbon Chemicals Co. With headquarters in New York, he will be responsible for negotiations and purchase of natural and refinery hydrocarbon gases.

Succeeding Mr. Ragland as superintendent of the South Charleston, W. Va. plant is D. B. BENEDICT, formerly assistant super-

FIRST IN MASSACHUSETTS, TOO!

FIRST with Consumers!

Mrs. Isabel Sullivan, Watertown, Mass., says:

"I never dreamed that *all of the work* could be taken out of washday—until I got my *Hamilton*. No more lifting and lugging heavy wet wash! No more reaching and bending. I'm through with clothesline calisthenics. Every day is a happy, *sunny* washday—from now on."

FIRST with Dealers!

Sam Lipsky of Banly's, Brookline, Mass., says:

"Our *Hamilton* Franchise is one of our most valuable assets. With the brand acceptance the *Hamilton* Dryer has in this territory, consumers are demanding that line. Our satisfied *Hamilton* owners are our best salesmen, but in addition, the manufacturer-distributor-dealer relationship makes for a topflight operation right down the line on this superior product."

FIRST with Distributors!

G. I. Cohen, Northeastern Dist., Inc., Boston, says:

"In our territory, dryers mean *Hamilton*. Enthusiastic, satisfied customers have formed a bulwark of *Hamilton* salesmen that is hard to beat. Many consumers are anxiously awaiting deliveries and as fast as cars roll in, new *Hamilton* users are added to the growing list of consumers who are throwing away the clothespin that is the 'badge of a drudge'."

Hamilton

HAMILTON MANUFACTURING COMPANY · TWO RIVERS, WISCONSIN

intendent of the plant in charge of chemicals and resins.

American Car & Foundry Co., New York, has named JOHN P. KRUMECH as vice president of Shippers' Car Line Corp., the tank car owning and leasing subsidiary of ACF. Mr. Krumech has been traffic manager of the company. ROBERT G. BROSSARD has been appointed sales agent in ACF's New York district office, moving there from the Cleveland office.

H. G. Evans

R. G. Halvorsen

The newly created position of senior vice president of Hamilton Manufacturing Co., Two Rivers, Wis., is being filled by HOWELL G. EVANS, formerly vice president in charge of sales. His principal duties will continue in the sales end of the business but he will also devote a larger portion of his time to long-range sales planning and overall policies. R. G. HALVORSEN, formerly sales manager of Hamilton's contract-distributor division, succeeds Mr. Evans as vice president in charge of sales. C. S. O'NEIL has been named vice president in charge of research, another new position in the organization. Recently he has served as director of research.

C. S. O'Neil
Hamilton

L. L. Tonkin
Hope

As the result of a recent meeting of the board of directors, JOHN A. CLARK, president of Hope Natural Gas Co., Clarksburg, W. Va., became a director of Consolidated Natural Gas Co., the parent company. He replaces LORING L. TONKIN, of the Hope company, who retired July 1.

Mr. Tonkin started with Hope Natural in 1912 and has served successively as meter engineer, superintendent of compressor stations, assistant general superintendent, assistant chief engineer, vice president, president, and board chairman.

He became president, general manager and director of Hope in 1939, and when the Consolidated Natural Gas Co. was formed in 1943, Mr. Tonkin became a member of the board of directors. He headed the directors of Hope Natural since June 1951.

Mr. Clark joined the Hope organization in 1912, and has served as meter and construction engineer, assistant general superintendent, general superintendent and chief engineer, and vice president in charge of operations.

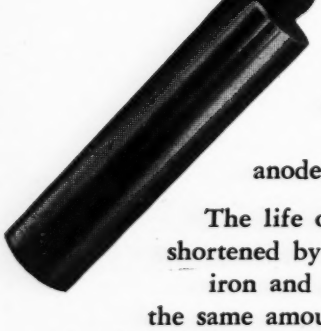
Expansion of its field sales organization to provide additional merchandising assistance for appliance distributors has resulted in the following Servel Inc. appointments: EDWARD B. MOCKEL and C. SIDNEY JOHNSTON JR. named regional merchandising counselors; and ROBERT B. PUCKETT, special sales representative on the factory staff in Evansville, where he will assist new distributors in setting up appliance sales organizations.

Both Mr. Mockel, formerly Boston district sales manager, and Mr. Johnston, former assistant branch manager in charge of Wisconsin operations, will aid in developing merchandising programs for distributors. Mr. Mockel, with headquarters in New York, will handle the eastern region. Mr. Johnston will be in charge of the midwestern region, with offices in Chicago.

Consolidated Edison Co. of New York Inc. has announced the following assignment changes involving new duties for several of its department heads:

R. FRANK BROWER, named assistant vice president, engineering; OTTO W. MANZ JR., assistant vice president, construction; M. LE COMPTE WARING, assistant vice president, Westchester county operations; WALTER B. FISK JR., system engineer succeeding Mr. Brower; THEODORE D. REIMERS JR. suc-

Anodes look alike too..



All fingerprints look alike at first glance . . . but a magnifying glass will show many differences. Anodes look alike too, but a spectrograph can also point out marked differences in anode purity.

The life of many anodes on the market today is shortened by use of metal impurities such as nickel iron and copper. An impure anode *may* deliver the same amount of electrical current as one of high purity, but its length of service is shortened. This leads to the unnecessary spending of hundreds or thousands of dollars for replacement of prematurely expended anodes.

At Standard Magnesium foundries, *spectrographic analyses* are made to inspect the quality of the anode and keep impurities at a minimum. A certified *spectrographic analysis* is furnished with each shipment, insuring you of the best economical protection at lowest cost.

You're sure it's pure when you buy from . . .

Standard Magnesium Corporation
TULSA, OKLAHOMA

ceeding Mr. Fisk as planning engineer; HARRY C. OTTEN, manager of system operations department, Westchester; DONALD S. KENNEDY, general superintendent, Westchester operations department; E. C. M. STAHL, assistant to Vice President A. H. KEHOE, production and operation; FREDERICK C. SHAUGHNESSY, manager of distribution operation department; and J. ELLIOT MCCORMACK, in charge of outside plant construction department.

LOUIS ELLIOTT and SABIN CROCKER, consulting engineers with Ebasco Services Inc., New York, have been awarded the Fellow Grade of membership in the ASME, an award presented by the society for acknowledged attainment in the engineering profession. Mr. Crocker received the award in recognition of his achievements in piping —its expansion and flexibility; its codes, standards and specifications; and its fabrication by welding—and for his research in metallurgy. Before joining Ebasco, Mr. Crocker had spent over 30 years with the Detroit Edison Co.

Several changes have been made in the General Controls Co., including appointment of RUSSELL STRONGMAN as branch manager in New York City. Formerly manager of the Glendale, Calif. firm's Automatic Controls Co., Mr. Strongman will also supervise the Newark, N.J., warehouse and branch office operation.

FRED WELDON, formerly regional manager for the eastern division, is now sales manager of the company and responsible for management of the new Skokie, Ill. factory. WILLIAM L. KELL, assistant sales manager, is, in addition, manager of the heating controls division. R. D. GRAYSON has been named manager of the appliance controls division and RUDY ROEDDER is now western refrigeration controls division manager headquartering in Skokie.

J. C. MATTHEWS has succeeded J. H. CONROY as sales representative in the Houston, Texas territory for the Barrett Div., Allied Chemical & Dye Corp. Mr. Matthews was formerly a senior member of the Barrett field service department.

JOSEPH A. MESSENGER retired last month as vice president, general manager, and director of Buell Engineering Co. Inc. to become a consulting engineer in Philadelphia. One of the pioneers in the dust-collection industry, Mr. Messenger, prior to his association with Buell, was with United Gas Improvement Co., Philadelphia, where for several years he was in charge of all gas distribution activities.

General manager of the newly-established commercial products department of the General Electric Co.'s air conditioning division is GEORGE K. IWASHITA. He was formerly manager of products planning of the division. The commercial products department will be responsible for air conditioning and refrigeration equipment used primarily in commercial and industrial establishments.

RAYMOND LATREILLE, of the Quebec Hydro-Electric Commission, Montreal, has been elected president of the Canadian Gas Assn. D. K. YORATH, Northwestern Utilities Ltd., Edmonton, and S. B. SEVERSON, Republic Light, Heat & Power Co., Buffalo, N.Y., were named vice presidents. Members of the executive committee include: P. W. Geldard, G. F. Knight, T. E. Cross, E. H. Rohrer, R. C. McPherson, F. W. Satchwill, R. M. Perkins, F. R. Palin, H. W. Durgy, and W. R. Ward.

Changes in the research department of the American Radiator & Standard Sanitary Corp., Pittsburgh, have resulted in the appointment of HERWERT WERKER as director of research. KURT KRAFFT has been named manager of the heating division of research succeeding Mr. Werker. In turn, ROBERT B. DUGGAN, design engineer in the coal and oil department, becomes chief engineer in that department, succeeding Mr. Krafft.

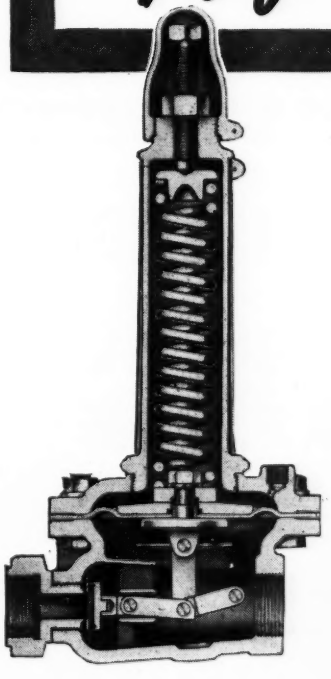
Appointments of WILLIAM ANDERSON as secretary and DAN J. EGAN as assistant vice president of Manufacturers Light & Heat Co. and affiliated Pittsburgh group companies of the Columbia Gas System have been announced. Mr. Anderson, prior to joining Manufacturers' legal staff earlier this year, was counsel for Pittsburgh Railways Co. Mr. Egan has had a 25-year career with Manufacturers, starting as a part-time clerk and advancing through several positions to become employee relations director in 1944.

Three advancements were made recently by Brooklyn Union Gas Co. men. ROBERT E. SCHILL, former assistant secretary in the executive department, is now assistant manager, economic research department. HAR-

IN THE HIGH PRESSURE FIELD

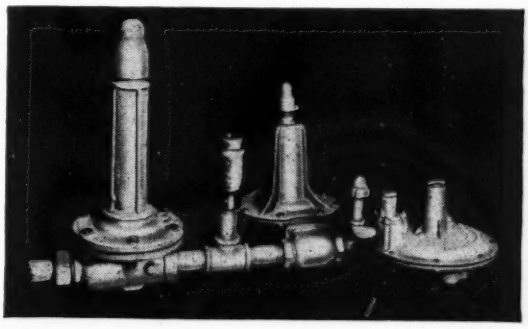
THERE IS SAFETY

IN *Reynolds* ...



Accurate, Safe Control

of tremendous pressures is an ever present problem in the gas field. Reynolds field Regulator illustrated at left is one of the many high pressure regulators built by Reynolds. It is thoroughly tested and proved in service. It handles up to 1,000 pounds safely reducing same to pounds. For more than fifty-five years Reynolds has designed and built gas regulators. Safety, accurate performance, years of service—these are some of the built-in factors responsible for Reynolds enviable position in the Gas Control Field.

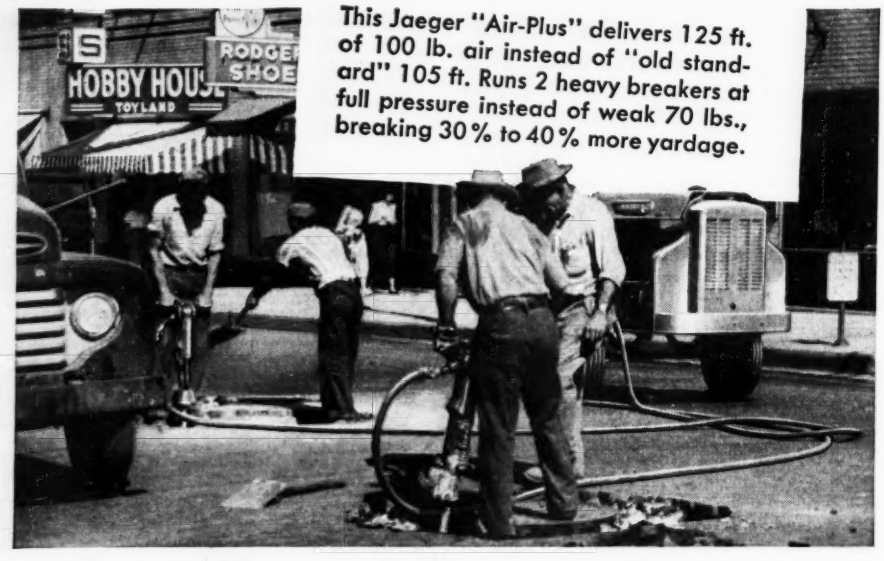


Reynolds Gas Regulator Co.

ANDERSON, INDIANA, U. S. A.

GAS CONTROL SINCE 1892

You Can Do 4 Days' Work in 3 with "New Standard" Jaeger Compressors



This Jaeger "Air-Plus" delivers 125 ft. of 100 lb. air instead of "old standard" 105 ft. Runs 2 heavy breakers at full pressure instead of weak 70 lbs., breaking 30% to 40% more yardage.

75 ft.
125 ft.
185 ft.
250 ft.
365 ft.
600 ft.

30% to 40% increases in production are yours with any "new standard" Jaeger from Model 75 that holds full pressure in a heavy pavement breaker up to Model 600 that runs 2 heavy wagon drills at full pressure with air to spare for hand-held drills. Jaeger Compressors deliver this 15% to 25% extra air at lowest cost per cubic foot of air of any compressor.

See your Jaeger distributor or write for Catalog JC-1.

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COMPANY_____

NAME_____ POSITION_____

STREET CITY ZONE STATE

OLD S. BIRKETT, research engineer, succeeds Mr. Schill in the executive department. FRANK R. BARNITZ has been named domestic sales manager. He recently served as supervisor of the apartment house group and retail sales supervisor.

The appointment of AUSTIN W. STRONG as assistant vice president has been announced by Southern California Gas Co., Los Angeles. He will become a general assistant to Vice President W. R. Davis.

R. B. YOUNG, formerly administrative assistant in the general standards department, has succeeded Mr. Strong as supervisor of the general standards department.

In his new position as vice president in charge of merchandising for Cappel, MacDonald & Co., Dayton, Ohio, HAROLD H. HEISLER will help intensify merchandising service to clients and expand liaison with the suppliers of merchandise awards appearing in the firm's prize incentive catalog. Mr. Heisler will headquarter in the firm's Chicago office.

J. EARLE DAVIES has been elected vice president and general sales manager of the Abbott Equipment Co., Bellows Falls, Vt. Mr. Davies was formerly associated with the Lowell (Mass.) Gas Co. as general sales manager.

The New Jersey Natural Gas Co., Asbury Park, N.J., has appointed DANIEL WILLIAMS and L. IRVING BOLLITT JR. as vice presidents. The firm, which recently took over operations of the Jersey Central Power & Light Co., named DALE OTTO as assistant vice president.

JAMES H. BINGER has been elected vice president of Minneapolis-Honeywell Regulator Co. Since 1950, he has been vice president and general manager of the company's Belfield valve division in Philadelphia. His new headquarters will be at the company's executive offices in Minneapolis.

LOUIS G. JAMES, assistant comptroller of Lone Star Gas Co. has been elected president of the Dallas chapter of the Controllers Institute of America . . . Special representative of the United Fuel Gas Co. with headquarters in Huntington, W. Va. is WARREN M. REESER, vice president of Amere Gas Utilities. S. W. WOODYARD succeeds Mr. Reeser as vice president and general manager of Amere . . . G. A. MOFFITT, Lone Star Gas Co., heads the Dallas chapter of the National Office Management Assn. for 1952-53 . . . GERALD T. BAUSLAUGH is the newly appointed assistant division superintendent of South Dominion division of the Dominion Natural Gas Co. Ltd., Buffalo, N. Y.

Milwaukee (Wis.) Gas Light Co. has named RICKARD H. LAURITZEN as assistant secretary and attorney . . . W. DOUGLAS LAVERS has become construction manager of Ebasco Services Inc., New York. He will be responsible for construction projects outside the U.S. . . .

As a part of his recent world tour, T. J. STRICKLER, vice president in charge of the Kansas City (Mo.) operations of the Gas Service Co., attended the three-day convention in Brussels of the International Gas Assn., to which he was a delegate from the AGA. Other stops were made in the Philippines, Japan, India, Egypt, the Holy Land,

Turkey, Greece, and France . . .

As a symbol of 50 years of service with Public Service Electric & Gas Co., Newark, T. WILSON VAN MIDDLESWORTH, treasurer, and EDWARD V. BOLLENBACH, chief clerk, engineering department, have each received a diamond lapel pin, presented by President George H. Blake. . . . DR. CECIL L. DUNN, former chairman of the Department of Economics of Occidental College, Los Angeles, has joined Southern Counties Gas Co., Los Angeles, as a financial analyst . . . JOHN E. OVERBECK, associated with the Columbia Gas System for 35 years, has been elected an assistant vice president of the Columbia Gas System Service Corp. . . . HARMON W. BOYES has become sales manager of the Chatham, Ont., district of Union Gas Co. of Canada Ltd. He will work under L. P. Patterson, district manager.

Obituaries

J. C. Reed

JOHN C. REED, under whose supervision the new research laboratories of American Radiator & Standard Sanitary Corp. in Louisville were constructed, died recently after a brief illness. He was 50 years of age. At the time of his death he was vice president, research, a position he had held since April 1951. Mr. Reed began his career with American-Standard in 1929 as a metallurgist in the research department. He subsequently served as brass engineer in Louisville, production engineer in the general manufacturing department, and manager of the research department. It was during his tenure as research department head that the heating laboratory, formerly located in Yonkers, N.Y., and the plumbing laboratory, formerly on the Louisville plant grounds, were consolidated into one laboratory in Louisville.

ALFRED E. FORSTALL, 86, consulting engineer in public utility problems, died early in July in Montclair, N.J. He was a former president of the American Gas Institute.

ELMER MALMQUIST, 58, superintendent of gas operations for the Public Service Co. of Northern Illinois, died recently. At the time of his death, Mr. Malmquist had been with Public Service for 35 years.

STANLEY GUELSON, 42, vice president in charge of manufacturing and a director of the Milwaukee Gas Specialty Co., died June 30 in Milwaukee. He became associated with Milwaukee Gas in 1936. In World War II he spent several years in the rocket development program at the California Institute of Technology. In 1946 he returned to Milwaukee Gas as a vice president.

WILLIAM W. WHERRY SR., director of office personnel of the Pacific Gas & Electric Co., Los Angeles, died last month in Evansville, Ind., while on a vacation. Before going to California in 1936, Mr. Wherry had been associated with the Kansas City (Mo.) Public Service Co.

Why 10 BANTAMS®!

BEFORE mechanizing their field operations with low-cost Bantam method, Ohio Fuel Gas Co. maintained a state-wide pipeline system with thousands of man-hours of hard labor, high lift trucks and all sorts of specialized equipment. Today all of this company's transmission line repairs are handled by *10 one-man-operated Bantam Back Hoes, working out of 8 regional garages.* Equipped with fast-change crane booms, hoist adaptors and backfill blades, high-speed Bantams now do the complete job of pipe unloading, trenching, placement and backfill . . . handle more *assignments per day at a big saving in labor and equipment.* Mobile Bantams also speed work around compressor stations, installing pipe, fittings, compressor units . . . constructing headers, raising lines above ground for easier inspection, etc. Why not investigate Bantam economy for your operations today.

Mail the Coupon

Less than $6000

For complete Bantam Back Hoe, less truck and mounting charge, F.O.B. Waverly, Iowa. (Subject to change.)

Schield Bantam Co. *268 Park St., Waverly, Ia.*

☐ Send details on truck-mounted BANTAM

Name.....Title.....

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SB-H-17

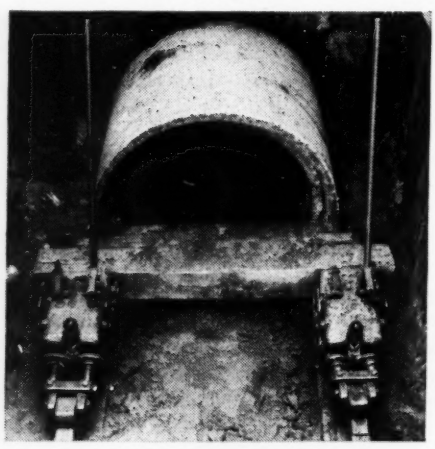
GETS MORE JOBS DONE AT LESS COST

SAVE HOURS,

CUT COSTS ON YOUR

PIPING JOBS

PUSH PIPE UNDER STREETS, TRACKS, walks, floors and other obstacles with a GREENLEE Hydraulic Pipe Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes—model shown above for pushing ¾ to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump also available for extra ease and speed of operation.



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GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 1948 Columbia Ave., Rockford, Illinois, U.S.A.

ASSOCIATIONS

AGA Nominees Named For October Election

Frank Smith

The AGA nominating committee has named 31 gas industry executives from 16 states and the District of Columbia for election as officers, directors and chairmen of sections and general committees at the Oct. 27-30 convention in Atlantic City. Officers, section chairmen and vice chairmen, and general committee chairmen will be elected for the 1952-1953 association year. Directors will be elected for two-year terms expiring in 1954.

Officer nominations include:

President—Frank C. Smith, president, Houston (Texas) Natural Gas Co.

1st vice president—Earl H. Eacker, president, Boston (Mass.) Consolidated Gas Co.

2nd vice president—F. M. Banks, president and general manager, Southern California Gas Co., Los Angeles.

Treasurer—Edward F. Barrett, president, Long Island Lighting Co., Mineola, N.Y.

Directors nominated for two-year terms: E. R. Acker, president, Central Hudson Gas & Electric Corp., Poughkeepsie, N.Y.; L. B. Bonnett, vice president, Consolidated Edison Co. of New York Inc., New York; Everett J. Boothby, president, Washington (D.C.) Gas Light Co.; Dudley B. W. Brown, president, Milwaukee (Wis.) Gas Light Co.; A. W. Conover, president, Equitable Gas Co., Pittsburgh; N. Henry Gellert, president, Seattle (Wash.) Gas Co.; Lyle C. Harvey, president and general manager, Affiliated Gas Equipment Inc., Cleveland; Frederic O. Hess, president, Selas Corp. of America, Philadelphia; Robert A. Hornby, executive vice president, Pacific Lighting Corp., San Francisco; Paul Kayser, president, El Paso Natural Gas Co., Houston; James F. Oates Jr., chairman, The Peoples Gas Light & Coke Co., Chicago; William T. Stevenson, president, Western Kentucky Gas Co., Owensboro, Ky.; R. G. Taber, president, Atlanta (Ga.) Gas Light Co.; George E. Whitwell, vice president in charge of sales, Philadelphia (Pa.) Electric Co.; Charles G. Young, president, Springfield (Mass.) Gas Light Co.

Section and committee nominees:

Accounting: chairman, Bernard S. Rodey Jr., ConEd; vice chairman, Paul E. Ewers, Michigan Consolidated Gas Co., Detroit.

Industrial and commercial: chairman, Terry Hart, Nashville (Tenn.) Gas Co.; vice chairman, C. C. Eeles, Ohio Fuel Gas Co., Columbus.

Residential: chairman, R. J. Vandagriff, Laclede Gas Co., St. Louis; vice chairman, Raymond Little, Equitable Gas Co., Pittsburgh.

Operating: chairman, Channing W. Wilson, Consolidated Gas Electric Light & Power Co., Baltimore; vice chairman, Frederick J. Pfluke, Rochester (N.Y.) Gas & Electric Corp.

Manufacturers: chairman, Gordon Lefebvre, Cooper-Bessemer Corp., Mt. Vernon, Ohio.

Publicity & advertising committee: chair-

Educational material selling home service work in the gas industry as a career was featured at the AGA-sponsored exhibit at the convention of the American Home Economics Assn. Home service directors serving as hostesses to educational visitors included (standing, left to right): Katherine Rathbone, Southern Counties Gas, Los Angeles; Jessie McQueen, AGA, New York; Ella Lambert, Milwaukee (Wis.) Gas Light; Ruth Soule, Brooklyn Union; Winnell Simmons, Houston Natural; Helen Mandigo, The Gas Service Co., Kansas City, Mo.; Luella Fisher, Iroquois Gas, Buffalo; Vivian Marshall, New Orleans (La.) Public Service. Seated, Mavis Lee Annett, Central Illinois Electric & Gas, Rockford, Ill., and Gertrude Berg, Milwaukee Gas.

F. M. Banks

E. H. Eacker

man, Willis M. Kimball, The Columbia Gas System Inc., New York.

Laboratories managing committee: chairman, Arthur F. Bridge, Southern Counties Gas Co., Los Angeles; vice chairman, Clarence H. Waring, The Gas Service Co., Kansas City, Kan.

It was announced that any 50 company members of the association can submit additional nominations by placing them in the hands of the association's managing director by Aug. 27.

Beard and Estill Elected

Two sections of the Instrument Society of America recently elected officers for the coming year. In New York, C. S. Beard, Ebasco Services Inc., was named president, succeeding C. E. Haggerty, New York City department of public works. In Tulsa, Gilbert Estill, superintendent of gas measurement for the Oklahoma Natural Gas Co., was elected president of the Tulsa chapter.

Other officers in the New York section include Harvey C. Mittendorf, Superheater Inc., vice president; R. A. Hutcheon, ConEd, secretary; U. P. Rothermal, Republic Flow Meters, treasurer. Tulsa section officers are J. F. Smith, Minneapolis-Honeywell, executive vice president; Don Sullins, Taylor Instrument Co., and J. J. Fox, Phillips Petroleum, vice presidents; A. J. Sesock, Westcott & Gries Inc., secretary; B. W. McKalip, Rockwell Manufacturing Co., treasurer.

Combustion Symposium

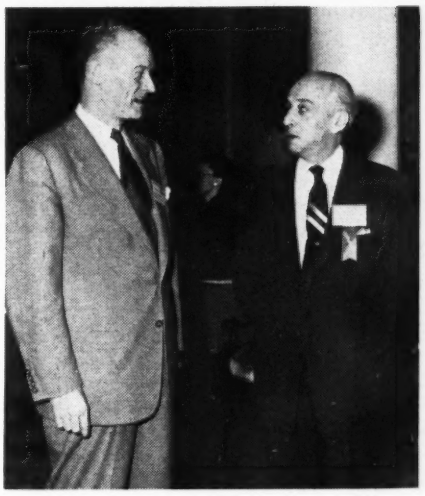
Emphasis is being placed on the physical aspects of combustion, particularly wave phenomena and turbulence, from both experimental and theoretical standpoints, in papers being reviewed for presentation at the 1952 international symposium on combustion scheduled for Massachusetts Institute of Technology on Sept. 1-5.

Much of the knowledge gained by combustion research since 1948 when the last symposium was held will be presented in some 100 papers from Great Britain, France, Holland, Belgium, Germany, and Japan, as well as from research laboratories and educational institutions in the U. S.

Sales Conference Speakers Stress Industry Needs

The possibility of losing the appliance market by default, through depletion of sales personnel and from lack of continuous sales effort, was stressed by speakers at the 27th annual New York-New Jersey regional gas sales conference held late in June at the Monmouth hotel, Spring Lake, N.J. The 175 gas sales executives in attendance were urged to support the many promotional campaigns being initiated by the AGA.

Declaring that gas utilities should set higher standards for all gas appliances, Carl H. Horne, sales manager, refrigeration division, Rheem Manufacturing Co., spoke for uniformity in suggested improvements.



Robert N. Laux, Kings County Lighting Co., Brooklyn, at right, is out-going chairman of the New York-New Jersey sales conference. Norman Millard, Bendix, spoke on gas dryer selling at the recent meeting.

Don't take anyone's word or accept unproven claims, *test it yourself!* Talk is cheap — Performance counts.

ASK FOR TESTING SAMPLES

Reducing Bushings
Insulating Couplings
Insulating Pipe Nipples
Insulating Meter Nuts
Ring Joint Flange Gaskets
(10,000 p.s.i. up!)

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SERVICE ENGINEERS, INC.

Manufacturers of Industrial Plastic Products

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Manufacturers find it difficult to maintain efficient tooling and production schedules when they receive requests for specific changes in models by individual gas utilities. The establishment of two or three classes of ranges was recommended, with the manufacturers stating how they wished to be classed.

The constant increase in the water heater market, with more than 2.5 million units becoming obsolete each year, was discussed by J. F. Donnelly of A. O. Smith Corp. National advertising by manufacturers, AGA, and GAMA has exceeded national advertising on electric water heaters.

In the automatic clothes dryer field, Norman Millard, Bendix Home Appliances, pointed out that although the sales volume had gained in the past five years, the gas industry had not shared too greatly in the increase. However, because of the excellent promotional work done in the past year or two, sales of gas dryers were up more than 100% in 1951, against a gain of 43% in electric dryers for that period.

Harold Jalass, Cribben & Sexton, told those in attendance that if war production ceases, a tremendous effort would be needed to make consumers absorb the additional 25% in durable consumer goods that would be on the market. The public is "automatic" conscious and advantage should be taken of this feature in gas appliances. "There is more modernity in gas appliances than in any other appliance that has public acceptance today," he said.

Hugh L. Wathen (left), South Jersey Gas, is new chairman of the New York-New Jersey sales conference. With him is Jack B. Frost, Brooklyn Union, new vice chairman.

Hugh L. Wathen, South Jersey Gas Co., Atlantic City, was elected chairman of the N.Y.-N.J. regional gas sales council for the coming year. Jack B. Frost, Brooklyn Union, was named vice chairman and Henry Rohrs, Elizabethtown Consolidated Gas, became a member of the council.

Home Service School Held

Sixteen eastern gas companies were represented by the home service directors at an equipment conference given recently by the home economics department of Pennsylvania State College, under the co-sponsorship of the Pennsylvania Gas Assn. and the Pennsylvania Natural Gas Men's Assn. Mary Brown Allgood, chairman of the commercial consumer services division, directed the week's course.

A wide range of subjects was covered, including ranges, refrigerators, water heaters, clothes dryers, washers and detergents, kitchen designing and planning, demonstration techniques, and sales.

Kraft Heads CNGA

W. H. Kraft

Warren H. Kraft, Honolulu Oil Corp., was elected president of the California Natural Gasoline Assn. at the annual meeting of the board of directors held last month in Los Angeles. Fred L. Hartley, Union Oil Co. of California, was elected vice president, and E. R. Millett Jr. was again appointed secretary-treasurer.

Among the directors elected are these utility men: F. F. Doyle, Pacific Gas & Electric Co.; M. L. Fort, Pacific Lighting Gas Supply Co.; Grove Lawrence, Southern California Gas Co.; and R. W. Todd, Pacific Lighting.

Men who know gas meter troubles know why Lancaster Metal Rim Diaphragms wear longer. Re-chrome leather has a solid pocket free from wrinkles. The pocket is made without blocking, wetting, stretching or forming—so leather fibers are alive and pliable. No rivets are used in center pans. Cord ends are fastened around outer metal rim flange without a knot—no chance of wearing a hole in the leather. *Send for a sample today.*

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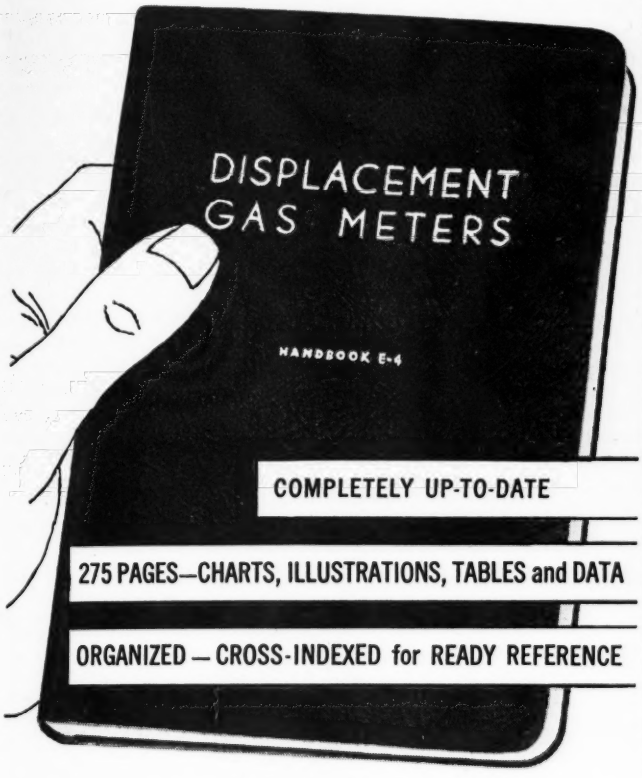

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THE MEASUREMENT OF GASES AT HIGH PRESSURE AND VACUUM
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TESTING HIGH-PRESSURE METERS
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REPAIRING TINNED STEELCASE METERS
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INDEX

As a special service to the Gas Industry, the American Meter Company offers the most authoritative guide ever published on operation, tests, maintenance and repair of Ironcase and Tinned Steelcase Meters—The New E-4 Handbook of Displacement Gas Meters, edited by John C. Diehl.

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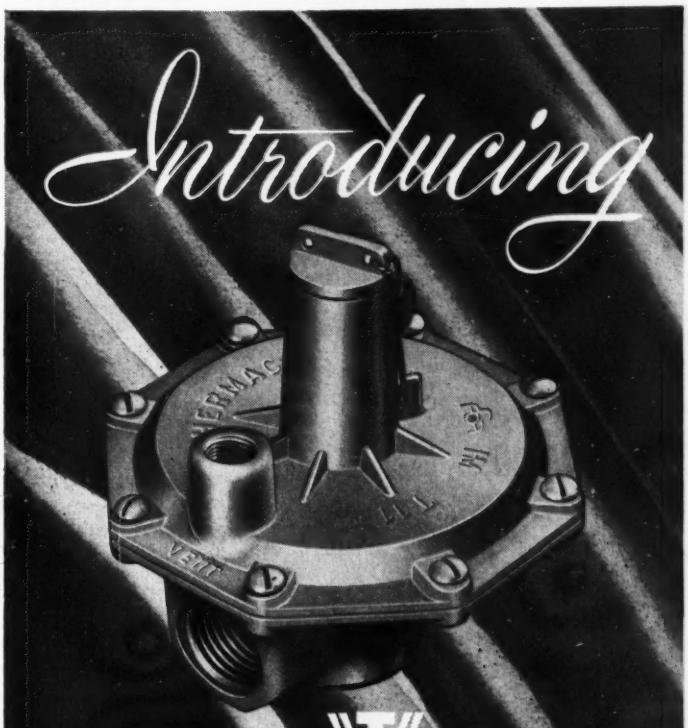

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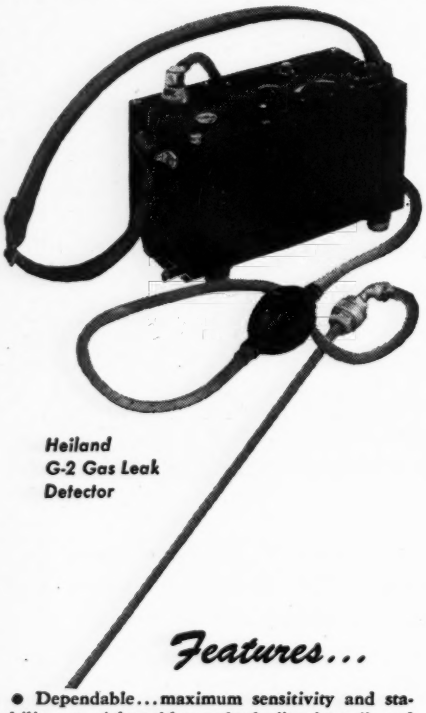

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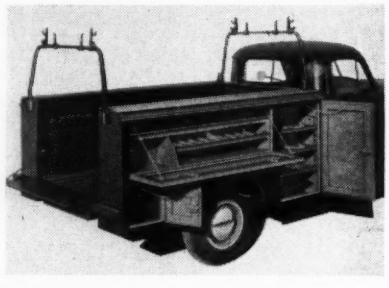
NEW PRODUCTS

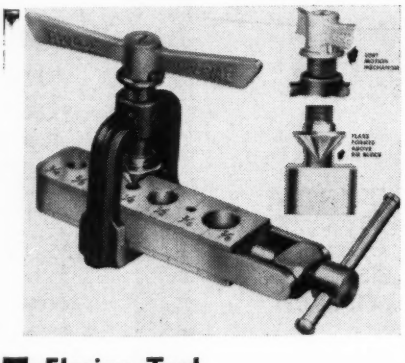


Service-Maintenance Body

Compartments on the new Powers-American service and maintenance bodies are equipped with shelves, trays, material hooks, and parts bins. Removable shelves in each vertical compartment are padded and furnished with elastic hold-down bands.

The illustrated model, Series 44 (without superstructure) is available in 75, 90, and 104-in. lengths, for installation on chassis having C.A. dimensions of approximately 40, 48, and 60 in., respectively. The Series 44-L bodies (with superstructure) can be furnished in 90 and 104-in. lengths, for 48 and 60-in. C.A. chassis. Optional equipment includes telescopic roof, hinged ladder rack, side-mounted ladder rack, pintle hook, rear bumper-step, pole setting spool, and other accessories to meet individual requirements.

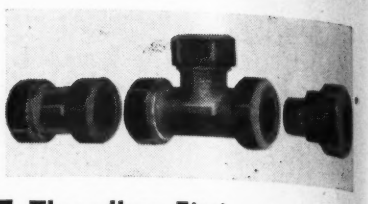
Model: Series 44 and 44-L.
McCabe-Powers Auto Body Co., 5900 N. Broadway, St. Louis 15.



Flaring Tool

For use with soft copper, steel, aluminum, and brass tubing, the new tool will make 45° flares on 3/16, 5/16, ⅜, ½, and ⅝-in. OD tubing for standard SAE flared fitting joints. Through the use of a lost-motion mechanism in the yoke which disengages the feed during the first revolution when backing off the cone, the face of the flare is automatically burnished after it has been formed. The flare is formed in the air above the flaring bar, assuring maintenance of the original wall thickness of the tubing at the base of the flare. The steel flaring bar is of the sliding segment type and has a single screw at the end with rod handle for leverage which provides quick, easy tightening.

Model: No. 500-F Rol-Air.
Imperial Brass Manufacturing Co., 1200 W. Harrison St., Chicago.

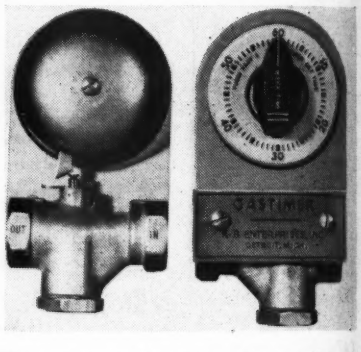


Threadless Fittings

A completely new line of malleable iron threadless fittings for joining standard-size plastic or steel pipe has been introduced under the trade name "Telsco." Featuring 10 different types and 111 different sizes of fittings, the line has couplings, adapters, 90° elbows, adapter elbows, straight and reducing tees, tees with threaded branches, and reducers and increasers. Size range is from ½-in. through 2 in.

Fittings are factory-assembled and ready to use on plain-end pipe, without threading, by inserting pipe end into fitting; fitting end nuts are tightened with an ordinary wrench. Rubber gaskets inside fittings protect pipe from strains of contraction, expansion, and vibration. Fittings hold joint permanently tight and are not affected by properties of air, water, gas, gasoline, butane, or propane. They will withstand temperatures of from 250° to 275°. The high-tensile, malleable iron castings are treated with a rust preventive which makes them highly resistant to corrosion. Gaskets are neoprene rubber.

Model: Telsco.
Texas Lawn Sprinkler Co. Inc., 5422 Redfield St., Dallas.



Automatic Gas Shutoff

A timing mechanism and automatic gas shutoff valve requiring no electric current for operation, the Gastimer is a self-contained unit with a capacity of 47,900 Btu per hour of 1000-Btu per cu ft, 0.7-in. specific gravity natural gas at 0.5 in. w.c. pressure drop; 25,800 Btu per hour of 500-Btu per cu ft manufactured gas, 0.6-in. specific gravity, at 9.5-in. pressure drop.

The solid-brass valve has ½-in. female inlet and outlet. For uninterrupted gas flow, the unit has a manual hold-open feature. Timer mechanism may be removed without removing the valve or cutting off the gas. Gas is automatically and positively shut off and a bell signal is sounded at the selected time. Pilot take-off is available upon request.

Model: Gastimer.
R. B. Enterprises Inc., 2932 E. Grand Blvd., Detroit 11.

Domestic Range

Featured on the Deluxe and Imperial lines of Detroit-Michigan Stove Co. is the new innovation, Top-Vue. With this feature, inspection of the oven is possible through the cooking top. By touching a button to illuminate the oven, one can inspect the oven at a glance.

Another new feature incorporated is the Signa Dial control, a semaphore type of indicator showing at a glance from any point in the kitchen the degree to which the burner has been turned on.

Model: Top-Vue.
Detroit-Michigan Stove Co., Detroit, Mich.

Clothes Dryer

Introduced at the June Market in Chicago was the new gas clothes dryer of the Stiglitz Corp. Four years of research and engineering have gone into the completely automatic dryer which features a top lint trap, turbo-vent, built-in sunshine, automatic cooling, and other outstanding features. Economy and speed are additional operating advantages.

Model: Sun-Aire.
Stiglitz Corp., Louisville, Ky.

Other New Developments

The Foxboro Co., Foxboro, Mass., has introduced a flow rule specially designed for rapid solution to problems of line size, flow rate, and orifice sizing. It features a reversible slide with scales for gas on one side, liquids and steam on the other, with each fluid identified by color. Overall length of the rule is 12 in.

In a combination purchase, the company also has available the seventh edition of "Principles and Practices of Flow Meter Engineering," by L. K. Spink, containing 418 pages of tables, curves and text, serving as a one-source reference of important data and an authoritative guide to correct methods of measuring flow.

* * *

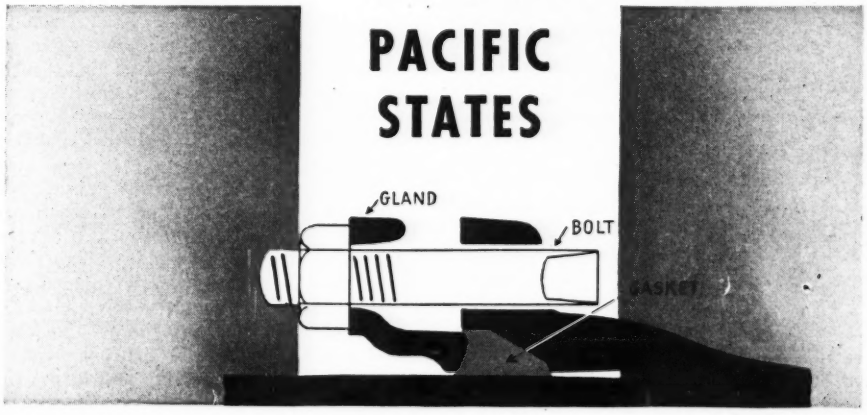
Harvey-Whipple Inc., Springfield, Mass., has introduced a new boiler designed for small homes. Features include: extra-heavy gauge vertical fire tubes, fire-box steel headers and shell, full length water leg surrounding refractory combustion chamber and fire box, flush or extended jacket, and built-in 200-gal. per hour tankless hot water heater (reversible for either steam or hot water operation).

A new line of automatic gas water heaters has been introduced by the Sands Manufacturing Co., Cleveland. Available in 20, 30, 40, and 50-gal. sizes, the quick-recovery line features heavy-duty galvanized steel tanks and outer jackets, Grayson controls, magnesium anode rods, and 100% shutoff controls.

* * *

A low-cost gravity warm air furnace designed primarily for low-cost housing has been developed by Delta Heating Corp., Trenton, N. J. Designated Model GA-75, the new furnace has a bonnet output of 75,000 Btu per hour. The gas-fired model is powered with a Delta inshot-type flanged burner. The unit is factory assembled with a full sized bottom plate to prevent air leaks when installed on an uneven floor.

McWANE
PACIFIC
STATES



"BOLTITE" *Means*—
BOTTLE TIGHT

McWane-Pacific Boltite Cast Iron Pipe has a flexible yet bottle-tight joint, of the stuffing box principle. A thick gasket is compressed in the stuffing box by a bolted follower-ring or gland. Gaskets furnished in special rubber compound, asbestos or other materials. Boltite is an ideal pipe joint for water, gas, steam, oil, chemicals or other liquids. Bolts and glands are special high strength cast iron which last as long as the pipe itself.

ONLY TOOL NEEDED
RATCHET WRENCH

One man makes Boltite joints, using only one tool—a ratchet wrench. All he does is socket the spigot in the bell, slip the gasket into the stuffing box and then tighten the bolts on the follower-ring. Saves time, labor and money. For further details, write.

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Kansas City 6, Mo.....1006 Grand Avenue
Dallas , Texas.....1501 Mercantile Bk. Bldg.

PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices
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Denver 2, Colo.....1921 Blake Street
Los Angeles 48, Cal.....6399 Wilshire Blvd.
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Salt Lake City.....Waterworks Equip't Co.

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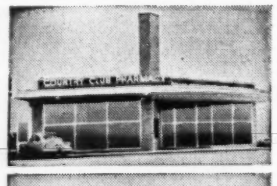
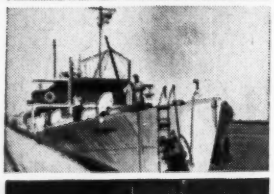
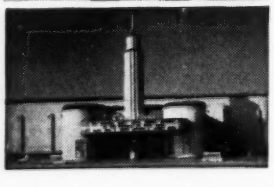


One of many modern pharmacies that depend on Ready-Power.

More and more super markets are using Ready-Power.



The "Frida," a Banana Boat, is Ready-Power equipped.



The Casa Linda theatre saves many dollars with Ready-Power.

Ready-Power air conditioning equipment is planned and designed to meet the most exacting requirements with the lowest possible operating costs.

Ready-Power design permits *continuous* operation at varying speeds, which is far superior to "on and off" types. This means that the air conditioning system performs at reduced capacity allowing for a constant dehumidification of the fresh air supply.

The dependable and economical performance of Ready-Power has been proved in hundreds of installations. Names of users will be furnished on request.

THE READY-POWER CO.
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Manufacturers of Gas and Diesel Engine Driven Generators and Air Conditioning Units; Gas and Diesel Electric Power Units for Industrial Trucks.

convention reports

Excerpts of several technical papers presented at the AGA production and chemical conference in New York May 26-28. Four additional digests will be published in September.

Problems Encountered in the Operation of a Standby High-Btu Oil Gas Plant

Perhaps the most difficult problem in standby operation is the selection and training of operating personnel. The training program should include not only operating procedures, but also safe practices in all the steps involved in production. Fire squads are another "must" in maintaining a safe plant.

Plant maintenance and checking is another item of importance. Maintenance should be the responsibility of one man.

Severe corrosion was experienced in the purification system and it was found that the gas contained sulfur dioxide and sulfur trioxide. To neutralize this acid and stop corrosion, ammonia gas was injected at the inlet of the relief holder.

Excessive pressure drops were found across the foul main and wash box, caused by the high rate of gas production, which is peculiar to liquid fired oil gas sets. This excessive pressure was overcome by reduction of the dip pipe seal in the wash box to one inch, addition of a number of 6-in. drips and a liquid separator to the foul main.

Serious difficulty, on the part of the customers, was experienced with pilot outages. Examination showed a gum-like deposit in the orifices caused by excessive light oil in the gas entering the distribution system. Light oil absorption scrubbers were installed to maintain a maximum of 10 cubic centimeters of light oil per 100 cu ft of make gas.

Even though the make gas was held at a uniform heating value, the burning characteristics varied over a wide range. By the use of a General Controls multithermocouple pilot connected to a millivolt meter, a measure of the comparative burning characteristics of the make gas was found. With the aid of this device, the operator was able to improve the quality of the make gas.

—Glenn M. Hammond
Michigan Consolidated Gas Co.
Grand Rapids

Production of Oil Gases As Substitutes for Natural Gases

This paper covers the progress made at the Institute of Gas Technology in solving the peak load problem by further development of the high-Btu oil gas process. Three methods for producing gases completely interchangeable with natural gas were studied. They are:

1. Production of essentially aromatics-free, low-gravity and low true oil gas heating value oil gases containing a minimum amount of blow-run and blast gases. This method requires high severities of cracking and high-efficiency oil-scrubbing and is most adaptable to peak-load, distillate oil operation in conventional high-Btu oil gas sets.

2. Gasification of distillate or residual oils at pressures from 20 to 40 psig in present-day high-Btu oil gas equipment modified for moderate pressure operation during the make oil admission period, or in novel continuous gasification equipment of the fluidized refractory bed or moving refractory bed (thermofor) type. The oil gases produced by this method may contain up to 65% methane-plus-ethane, and thus more nearly approach the composition of natural gas.

Pressure gasification would require modification of existing high-Btu oil gas sets to permit pressure build-up during make oil admission. Except for a small reduction of oil efficiencies, this process will not introduce any new operating problems and should be equally applicable to distillate and residual oil operation. Its greatest utility would be in application to new continuous gasification equipment, now under development on a pilot plant scale.

3. Catalytic upgrading of properly conditioned oil gases produced under present-day operating conditions with a hydrogenation catalyst at temperatures from 300 to 600° F. The net effect of this upgrading is similar to that of pressure gasification in that it produces a gas high in methane and ethane (up to 95% by volume) with an equivalent reduction of the hydrogen and olefins, primarily ethylene, in the original oil gas.

The catalytic auto-hydrogenation process is not affected by the source of the gas after the higher unsaturates and the objectionable sulfur compounds have been removed or reduced to acceptable levels. Best results will be obtained with this process if the hydrogen-to-ethylene ratio of the feed oil gas is high, preferably above one. This requires moderately high severities of cracking or production of the oil gas under moderate pressure. While the oil gases used as feed can be produced in conventional high-Btu oil gas equipment, additional purification may be required. The auto-hydrogenation reaction is exothermic and will require heat exchange equipment in addition to a reactor. Except for catalyst replacement, no major processing costs are anticipated.

—H. R. Linden and others
Institute of Gas Technology
Chicago

This is believed to be the first instance where plastic pipe and fittings have been stored in the same manner as steel pipe. Pictured is the Houston, Texas warehouse headquarters of Houston Oil Field Material Co., stocking Kraloy plastic pipe, a product of Golden Bear Manufacturing Co., Los Angeles. William B. Stallings (right) is tubular manager of HOMCO. With him is J. D. Kelley, Hydraulic Equipment Inc.

Economics of Supplying Peak Gas Loads

This study points out some of the tools that are available to keep the curve of the cost of gas from rising as fast as the send-out rises on peak days. It is not at all hard for an individual company to develop its own degree-day and load distribution curves. Using these and its own investment costs and operating conditions, a reasonably correct answer to the local problem can be obtained.

An adequate supply of reliable figures on investment, maintenance and operating costs for the various methods of producing gas of suitable quality would be very helpful. Considerably more reliable information is also needed concerning suitable quality or interchangeability of gases. The need for further development of low investment and standby cost peak load gas manufacturing processes is evident.

The installation of equipment which can be operated at lower capacity with inexpensive fuels during moderately cold periods, and at high capacity with expensive fuels during peak sendout periods should be carefully considered. Processes which do not require scrubbing, purifying, and by-product handling equipment are advantageous for producing peak load gas.

The storage of natural gas in high pressure bottles has several advantages to offset its high investment cost. A study of the record of duration of cold spells in an individual territory will give a good picture of the way this type of storage can be operated effectively.

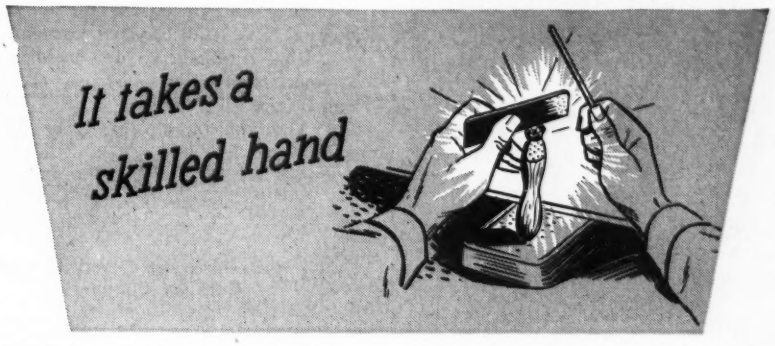
The value of underground natural gas storage at a point somewhat distant from the location where it is required can be determined by applying the same fixed charge and operating expense principles that are used for manufacturing.

The great variation in the operating costs of peak load production methods points out an idea which might be considered. A group of companies being supplied with natural gas from the same company could combine their peak production operations so as to operate the low cost equipment of the group to full capacity before the higher cost equipment went into operation.

—J. W. Carroll
Philadelphia Electric Co.
Chester, Pa.

How Does Coal Coke?

Bituminous coals consist of complex aggregations of organic compounds and/or polymers whose molecular weight and structure vary widely. When such materials are heated, the more fusible components soften, the more volatile vaporize, and the thermally less stable decompose. It has been shown that available experimental data on the thermal decomposition of coal fit the concept that coal carbonization, with consequent coke formation, is the resultant of the competing and simultaneous processes of fusion (with or without simultaneous depolymerization), solvent extraction, vaporization, decomposition, and polymerization. The interaction of these processes and their kinetic relationships for different time-temperature histories govern the yield and quality of coke and other products of carbonization. For a coal and/or other material to give a well-fused, coherent residue, the following re-



It takes patience, precision, and the highest degree of human skill to change, with a few light taps, a relatively worthless stone to a priceless gem. In the diamond cutting industry, fortunes rest on the *human equation.*

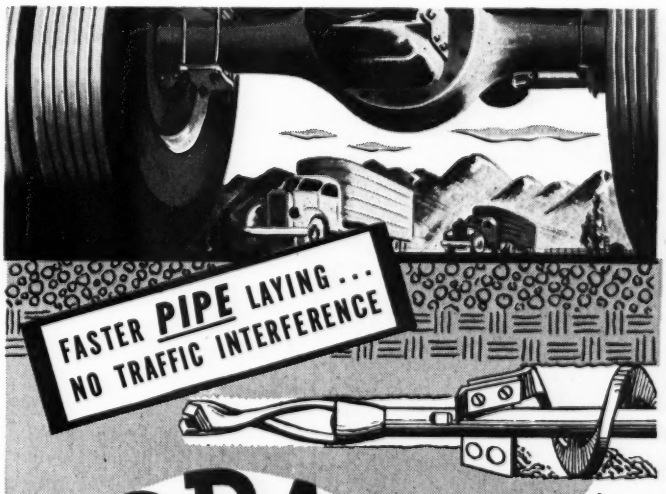
On the human equation, too, rests the efficiency of your cathodic protection system. Efficient corrosion control not only requires the use of the best equipment available, but depends on an exacting analysis of *your* problem, and design, installation and testing by top-notch specialists in the field.

Hundreds of operating installations attest to the dependability and skill of the ERP engineer. Highly trained, and backed by years of experience, he can help you solve *your* pipe corrosion problems too. E-20.

ELECTRO RUST-PROOFING CORP. (N. J.)
BELLEVILLE 9, NEW JERSEY
REPRESENTED IN PRINCIPAL CITIES IN THE UNITED STATES

PIPE-PROTECTION DIVISION

OVER 15 YEARS OF CATHODIC PROTECTION ENGINEERING, RESEARCH AND DEVELOPMENT



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quirements for coking need to be satisfied:

1. That an appreciable fraction of the material fuse at an elevated temperature.
2. That simultaneous decomposition and polymerization occur at or near the fusion temperature.
3. That the vapor pressure of the fluid material be quite low.

—Frank W. Smith & Ralph L. Brown
U. S. Bureau of Mines

Improvement of Catalysts and Catalyst Supports

Catalytic cracking, initially developed for peak-load gas production, has more recently become an important base-load gas production operation in the catalytic conversion of natural gas. Factors which may provide decreased investment costs thus become vital. Improved catalyst effectiveness is one element in increasing plant capacity. A laboratory and pilot-plant study of supports for nickel cracking catalysts revealed periclase (fused magnesium oxide) to be particularly effective; certain alumina preparations and selected refractory compositions were also found useful. Addition of small amounts of magnesium oxide or aluminum oxide promoter to the nickel, by co-impregnation, enhanced the activity of stable but relatively low-activity catalyst preparations. Possible decreases in nickel concentrations were indicated as a means of conserving nickel in case of limitations in nickel supply.

—C. H. Riesz and others
Institute of Gas Technology
Chicago

Controlling Nuisance Odors at Odorization Stations

Odorizer stations ordinarily should be located as far away from present and future habitation as possible, but the Binghamton (N. Y.) Gas Works Co.'s odorizer was installed in the center of town. A magnetic tank gauge (similar to those used on propane tanks), packless valves, and an all-welded piping system with two unions as the only breaks in a solid piping system were employed. An almost odor-free installation resulted during normal operation.

Odorizers in general operate better where the static gas pressure is constant. Inexpensive equipment cannot correct a varying pressure. The expenditure of rather large sums of money for nuisance odor control generally proves well spent in the long run.

Generally speaking, the odorization station will cause less trouble if the installation is simple and the automatic devices are few. There is one *must* on any odorizer installation: make sure that the odorizer cannot flood odorant into the gas stream.

There are several types of odorizers. We have had very satisfactory results using vaporizing by-pass type odorizers on gas volumes up to 15 MMcf of gas per day with concentrated odorants.

The most important consideration regarding odorization is the operating personnel. Keep it a one-man or one-crew operation.

—P. L. Covell
Minneapolis (Minn.) Gas Co.

Recent Developments in the UGI Cyclic Catalytic Reforming Process

The UGI Cyclic Catalytic Reforming Process has been highly successful in reforming natural gas. Recently the process has been adapted to the reforming of butane.

If the CCR unit is cracking natural gas and it is desired to shift to butane, all that is necessary is the use of more steam purge to cool the catalyst somewhat. This can be done by a higher steam rate during the normal steam purge portion of the cycle or by temporarily lengthening the steam purge period. In no event should the changeover require more than a minute. Conversely, if the unit is cracking butane and it is desired to shift to natural gas the blow period can be temporarily lengthened in order to increase the catalyst temperature.

The successful utilization of butane in the CCR units considerably widens the field of usefulness for this type of gas making equipment.

—Edward H. Smoker
United Gas Improvement Co.
Philadelphia

Natural Gas Pipeline Deposits

The increasing importance of natural gas pipeline deposits prompted the Pennsylvania Natural Gas Men's Assn. to approve for study at the Pennsylvania State College the subject "Dust in Natural Gas Pipelines." Samples of deposits submitted by member companies were studied. Without exception, iron compounds predominated in all samples; in all but one sample, iron oxides were the major components. Mineralogical examinations found most of the iron oxides in the forms of goethite and magnetite. Several samples contained more than 15%

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silica, and a group of samples from a common source contained about 14% sodium chloride. The percentage of construction dirt found in the samples studied was generally small. The major source of the common pipeline deposits is the pipe itself, mill-scale being a source of magnetite and subsequent rusting furnishing other oxides.

—L. T. Bissey
Pennsylvania State College
State College, Pa.

Design and Operation of Oil Foggers at Baltimore

The new type of hot oil fogger developed for operations at Baltimore embodies the principles of heating the sweep gas rather than supplying direct heat to the oil; continuously contacting the hot gas with fresh oil, and continuously removing the residue of unvaporized oil from contact with the gas stream. The fogging rate is positively controlled through the rate at which oil is added to the gas by a controlled-volume pump. Two years of trouble-free operation have demonstrated the advantages of this type of fogging equipment. The fog produced has excellent stability, and has been found widely distributed throughout the system.

A means of clearly establishing the presence of oil fog in the gas has been developed.

—O. W. Lusby
Consolidated Gas Electric Light & Power Co.
Baltimore

Influence of Substitute Gas Compositions on Interchangeability with Natural Gases

This study presents an analysis of the combustion performance of oil gas and oil gas-natural gas mixtures substituted for two natural gases at the adjustment manifold pressure on seven selected critical appliance burners adjusted to soft, medium, and hard flame settings on each of the two natural gases. This study also includes an analysis of the combustion performance of the two natural gases on these same seven critical burners adjusted on selected oil gases.

The gases tested were two natural gases, one a high-inert type and the other a high-methane type, and various oil gases, scrubbed and unscrubbed, of varying aromatic content

CORRECTION

Frank E. Kulman, engineer for Consolidated Edison Co. of New York and author of the two-part article "Corrosion Protection for New York City's Mains" which appeared in the June and July issues of GAS, has clarified footnote 2 on p. 44 of the June issue.

AGA report DMC-50-15 deals with the general design specifications of the radial main in New York including the selection of the approximate route of the main and the sizes and lengths of pipe. It was a subcommittee of the Greater New York Committee on Electrolysis that made the detailed studies and recommendations for electrolysis and corrosion protection, their report forming the basis for AGA paper DMC-52-2 "Corrosion Protection of Natural Gas Mains in New York."

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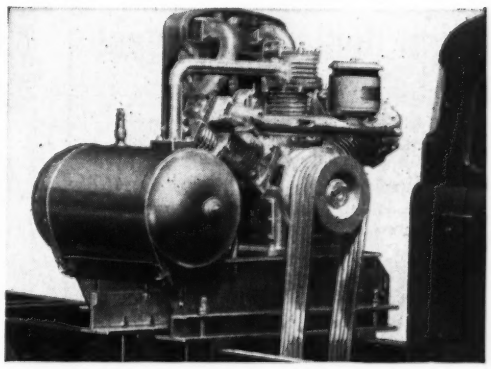

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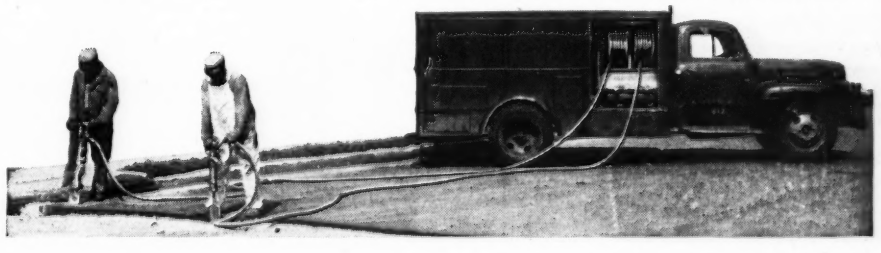

and heating value, diluted to a heating value of 1000-1050 Btu/Scf with a synthetic blow-run gas (composed of 80% nitrogen and 20% carbon dioxide). The degrees of substitutability of the oil gases for the two natural gases and of the natural gases for selected oil gases are reported. The substitutability of the oil gases for each of the natural gases after adjustment of the burners at rated input on the natural gases is given in terms of the maximum percent oil gas in the oil gas-base gas mixture which exhibited satisfactory combustion performance on these critical burners. Correlations are presented relating the substitutability of the oil gas with the true (diluent-free) oil gas heating value.

—D. L. Nicol and others
Institute of Gas Technology
Chicago

Effects on Scrubbing High Btu Gases

The South Carolina Electric & Gas Co. in 1950 installed a light oil scrubbing and recovery plant which has been in continuous operation ever since. No operating difficulties have been experienced with the chemical end and only one slight shutdown due to cooling water troubles. Six hundred and thirty-five thousand gallons of oil has been produced or 0.81 gals./Mcf. Some plants have experienced stoppages from sludge formation in the heat exchangers and low velocity points. The light oil produced is a valuable product and can be easily sold. Scrubbing reduces accumulation in the drips, reduces customer service complaints and makes a stable gas for base load, peak shaving, or standby.

—John O. Sholar
South Carolina Electric & Gas Co.
Columbia

TRADE LITERATURE

REFLIN CO., Dept. A-9, 8525 Higuera, Culver City, Calif.—A light-weight, corrosion-resistant, thermosetting plastic and Fiberglas-reinforced tubing is described in a new four-page brochure. Called Reflin, the tubing is said to be suitable to natural gas, and other fuel piping systems, underground conduits, etc.

SURFACE COMBUSTION CORP., Toledo 1, Ohio—Practical applications of direct, fuel-fired batch and continuous furnace designs in the ferrous and non-ferrous industries are described in a new bulletin, SC-156. General information is also given on possible applications of convection heating and the utilization of auxiliary materials handling systems.

SELAS CORP. OF AMERICA, Philadelphia 34—Bulletin SC-1000, "Selas P-R Gas Burners," describes multiport flame type gas burners used in heat processing applications such as high temperature alloy brazing; glass fire polishing; heating solder pots, core ovens, and die molds; soldering; baking; tempering and hardening. Capacities and specifications are given with appropriate dimensional drawings.

A second bulletin, SC-1006, "Selas Automatic Fire Checks and Safety Blowouts—Combustion Safeguards," discusses the two protective devices used in piping systems of gas-and-air combustion systems.

Two revised bulletins, SC-1007 and 1008 ("Selas Liqui-Jectors") pertain to equipment for the removal of water, water-oil emulsions and dirt from compressed air and gas lines.

MINNEAPOLIS-HONEYWELL REGULATOR CO., Brown Instruments Div., Station 40, Wayne & Windrim Aves., Philadelphia 44.—Recent technical bulletins issued include Bulletin Index 100-A, an index of technical literature from Honeywell's industrial division. A numerical listing and alphabetical cross index for specification sheets, instrumentation data sheets, catalogs and other literature are contained.

Specification Sheets 710 and 708 describe Brown indicating and recording pressure gauges with pneumatic control. Construction and engineering details are included in the 4-page bulletins.

WEBSTER ENGINEERING CO., Tulsa, Okla.—Bulletin B/9 fully illustrates and describes the Webster Combinetic gas and oil burner, a combination of the Webster Kinetic gas burner and a pressure atomizing oil burner. Specifications and installation information are presented in the 4-page bulletin.

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POSITION WANTED — EXECUTIVE IN CHARGE of operations in natural gas utility serving 15,000 customers desires change in employment. A graduate engineer with 23 years experience in all phases of distribution and utilization of natural and mixed gas including engineering incident thereto, was previously employed by gas utility serving 65,000 customers. Box 195, GAS, 198 So. Alvarado, Los Angeles, Calif.

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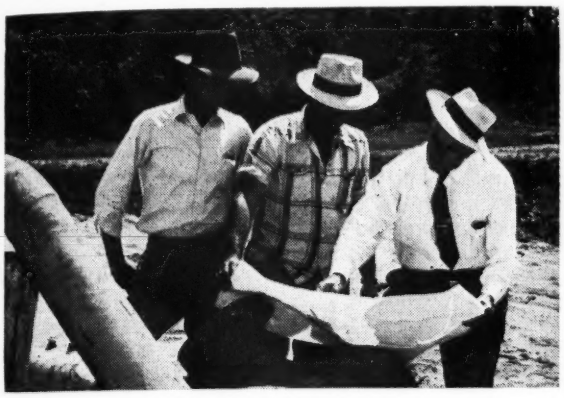
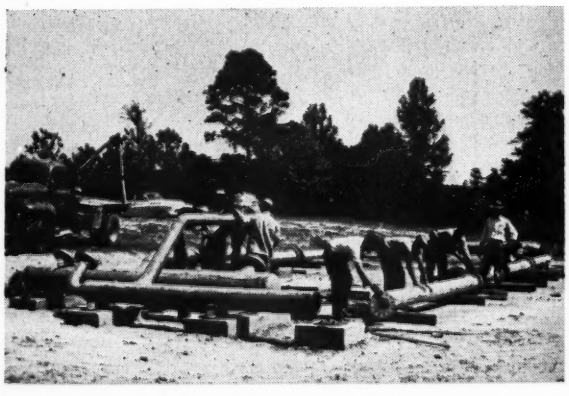
GAS PIPELINE NEWS AND FEATURES



Plans for an inter-connection measuring station near Selma, Ala., are studied by (left to right) James Edwards, foreman of Transco's Crew 1, T. A. Ferguson, division engineer, and District Superintendent Eldon V. Hunt.



Assembling of the pipe for the Transcontinental-Southern Natural inter-connection near Selma, Ala. The Transco crew is stationed at Selma.

In the foreground a crew is shown cleaning an emergency line pipe at Transco's compressor station near Alexander City, Ala. A rolling-rig is used, the power take-off being from a Ford tractor. The crew worked out an ingenious technique to eliminate manual operation by providing a short jack shaft to utilize tractor power for rolling the pipe. The power comes off the rear hub, the jack shaft being fastened to the hub by an adapter, engaging bolts on the hub. A universal joint is attached at the rig end of the jack shaft.

Companies cooperate for mutual protection

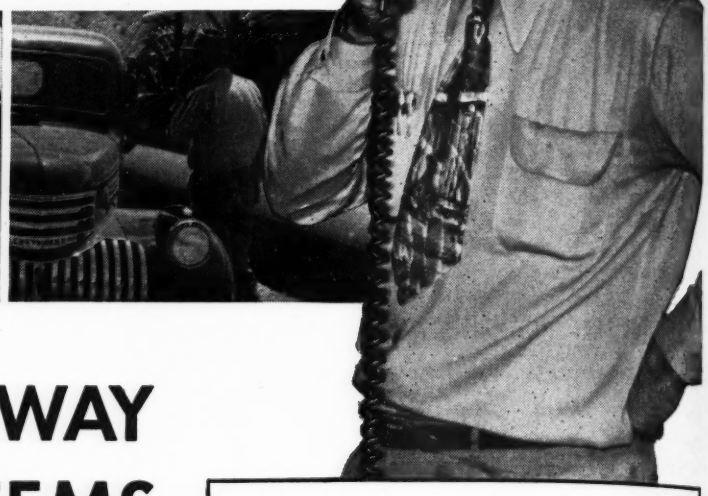
SAFETY LINK

Two of the gas transmission companies that have worked out inter-connections of lines at vantage points for emergency purposes are Transcontinental Gas Pipe Line Corp. and Southern Natural Gas Co.

In the pictures here part of the activity in connection with making a link-up of the two companies' lines near Selma, Ala., is shown. Inter-connections, such as the one being effected at the Alabama point, give mutual protection to transmission companies and assure gas consumers added guarantee of continued flow of gas.

Vital Contact

IN PIPELINE COMMUNICATIONS



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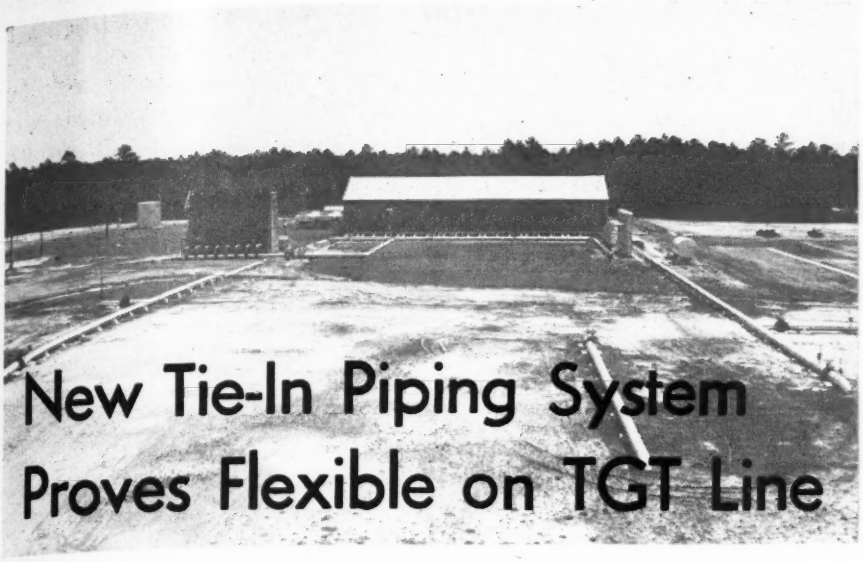


New Tie-In Piping System Proves Flexible on TGT Line

A TIE-IN piping system that combines flexibility and safety and at the same time solves all design and operational difficulties has been designed by Tennessee Gas Transmission Co. of Houston, Texas.

Four major requirements must be met in designing a tie-in piping system to connect the mainlines of a natural gas transmission system with the compressor stations located along the system. They are:

1. The piping should be so interconnected that each compressor engine or building can pump from any of the several transmission lines passing through the plant yard.

2. A simple reliable system to shut down and blow down the compressor plant in event of emergency should be incorporated.

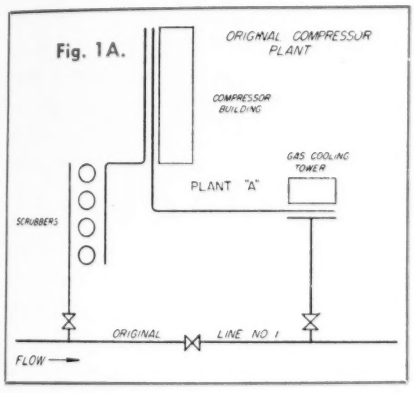
3. The pipe and fittings should be structurally sound in order to stand up adequately under line pressures, various mechanical loads caused by changing pressures and temperatures, and vibration or fatigue loadings.

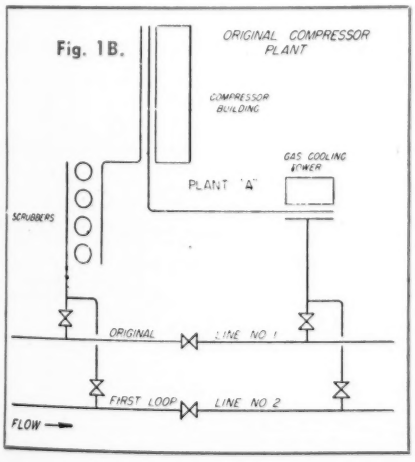
4. The piping should be flexible enough so that additional pipelines and compressors can be installed and tied in with existing facilities remaining in service and without using hot-tap valves.

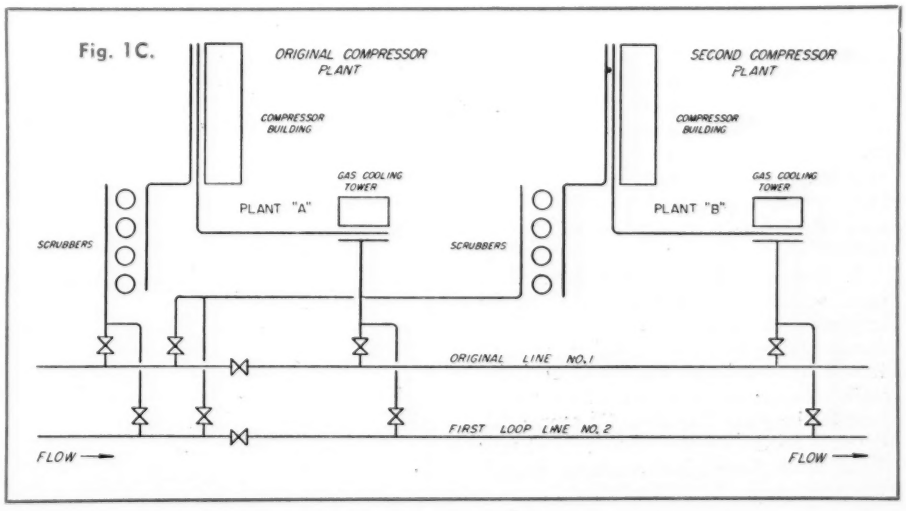
In the past the industry has used tie-in connections and valving consisting of a mainline block valve and two side valves, including one for plant suction and one for plant discharge. *Fig. 1A* depicts a typical industry tie-in of this nature. The tie-in will meet the four general requirements given above, but when one or more mainline loops are added along with additional compressor buildings to pump the gas, it quickly runs into difficulties.

Steps required to follow this plan to tie in the first loop line to the existing compressor station are illustrated in *Fig. 1B*. While this piping arrangement is not particularly complex, it should be noted that (1) the tie-over lines to the first loop must cross the original lines; (2) these large diameter lines, if carried underground, would have to go rather deep so that several bends would be required to make the necessary changes in elevation, and (3) only two additional side valves are needed for the tie-in as well as a new mainline valve.

Fig. 1C shows the steps required to add a second compressor station to this plant by tying it in to both pipelines. This second building usually would be on the same side of the pipeline as the original building. Since the first building normally is built opposite the mainline block valves, it will be necessary to run a suction or discharge line from the new building parallel to the mainlines for a considerable distance to get on the proper side of the existing mainline block valves for the required suction or discharge tie-in. Presuming both pipelines 1 and 2 are in service, the tie-in valves either must be installed by the hot-tap process or the lines must be taken out of service and blown down so the tie-ins can be made with regular valves. While these lines are shut down, a considerable service curtailment will result. And if hot-tap valves are used, they must be of smaller sizes, and there will be a consequent pressure drop within the plant yard piping.







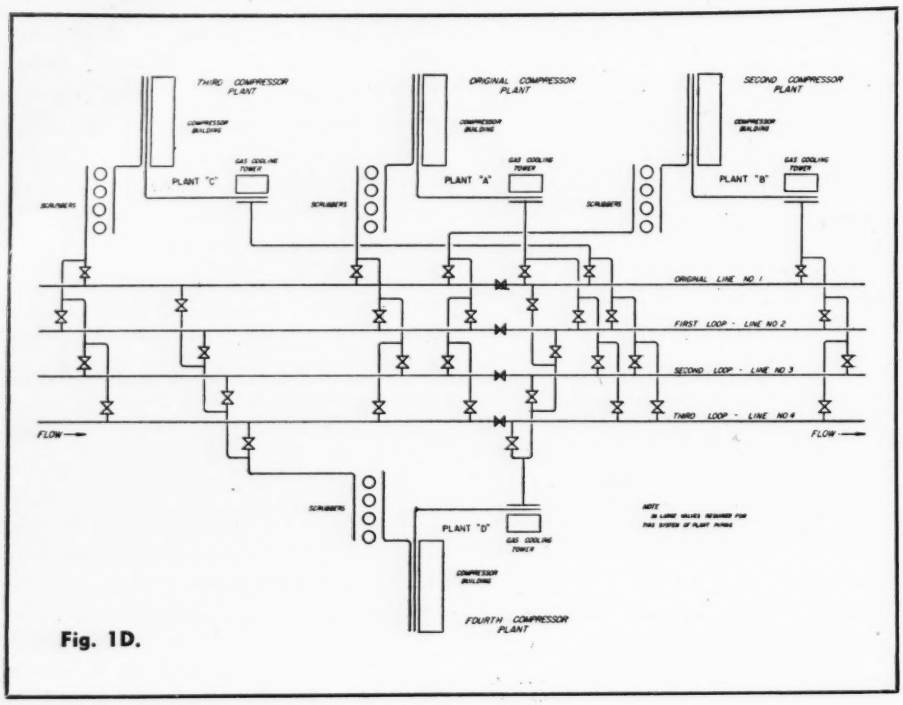


Fig. 1D.

But it is when we follow this pattern through to a plant yard with four compressor buildings and four pipelines crossing the yard that we encounter major difficulties. As shown in *Fig. 1D*, we have a very complex piping system on our hands. Here are some of the considerable design and operational difficulties involved:

1. Many hot-tap valves must be installed or many facilities shut-downs must be made.

2. Numerous cross-overs of large-diameter, high-pressure gas lines must be made involving a considerable number of pipe bends and the laying of some lines at excessive depths. Tie-in valves for one building must be located near to and sometimes among valves for another building, making it hard for operating personnel to tell which is which.

3. Many valves must be installed so near the plant facilities that in event of a failure involving the facilities, it might be difficult or impossible to reach the facilities to operate them.

4. To isolate each compressor building from the pipelines, if it is tied in to all four lines, would require operation of eight valves. Thus 32 valves must be operated to isolate a four-compressor-building plant, and in addition four mainline block valves must be opened to by-pass the plant. These valves would have to be operated as a routine procedure, as well as during an emergency.

5. Because the future growth of the plant could not be envisioned at the time of the original construction, in most cases where compressor buildings are added to the plant it will be found that there will be light-wall, cross-country pipe immediately adjacent to the plant facilities. Of course this depends on the amount of heavy-wall pipe installed in the original mainline through the plant yard.

For these reasons, if this method of piping is used it becomes very nearly an impossibility to fulfill the basic design points described. As a solution to this problem a piping system was developed by Tennessee Gas which fulfills all major requirements of a practical design and allows the tie-in of additional pipelines and compressor buildings with no sacrifice of design strength or service curtailment.

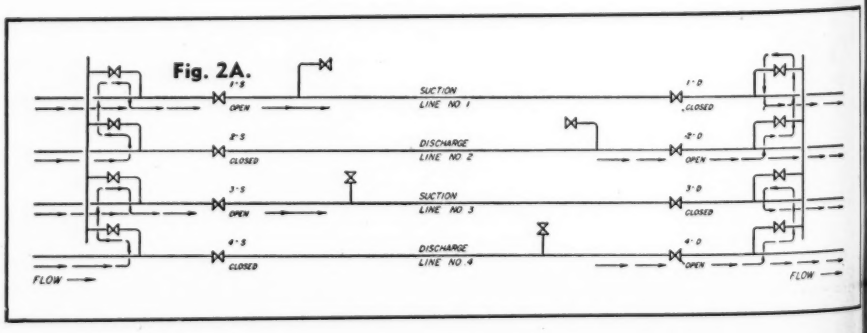
Basic design of this new piping system includes four complete pipelines across the compressor yard using two mainline block valves in each pipeline in place of the conventional single block valve. Located at the extreme limits of the plant site, these block valves are beyond any point where it would ever conceivably be desired to build more compression facilities. A cross-over manifold is built at each end of the plant yard and is tied in to each pipeline on the pipeline side of the block valve.

It will be seen from schematic *Fig. 2A* how the installation is made and operated. Valve operation is as follows:

The block valve on Line No. 1 (mark 1-S) on the suction side of the plant, is left open while the block valve (marked 1-D) on the discharge side of the plant is left closed. Line No. 3 is treated in the same manner. The reverse is applied to Lines 2 and 4, i.e., the block valves on the suction side of the plant are closed and the block valves on the discharge side left open. All of the cross-over manifold valves are open. By means of the suction manifold the incoming flow of gas from four lines is combined into two streams flowing into the plant yard in Lines 1 and 3. Suction pressure thus will exist across the plant yard as far as the block valves located on the plant's discharge side. In the same way, the discharge gas from the plant flows out on Lines 2 and 4 only, through the open block valves, and is distributed by the discharge manifold to load the four pipelines leaving the plant. So regardless of where a compressor building is built between the two block valves on each line, two suction lines and two discharge lines exist to tie to, eliminating the need to construct any piping parallel to the mainline.

Fig. 2B shows the manner of tying in a compressor building to these four pipelines. The block valve (1-S) is closed and the section between 1-S and 1-D in the plant yard is blown down. This line is cut and a tee and side valve are installed; the side valve is closed; valve 1-S is reopened and the line is put back in service.

While this No. 1 line is shut down, the side valves which provide suction to any other previously constructed compressor building will naturally be closed. However, the other plants will obtain suction from the tie-in connection to Line No. 3, and all pipeline and plant facilities thus will continue operations while Line No. 1 is shut down within the station yard. A slight decrease in system capacity results, of course, from the extra pressure drop caused by combining the flow of all the gas through Line No.



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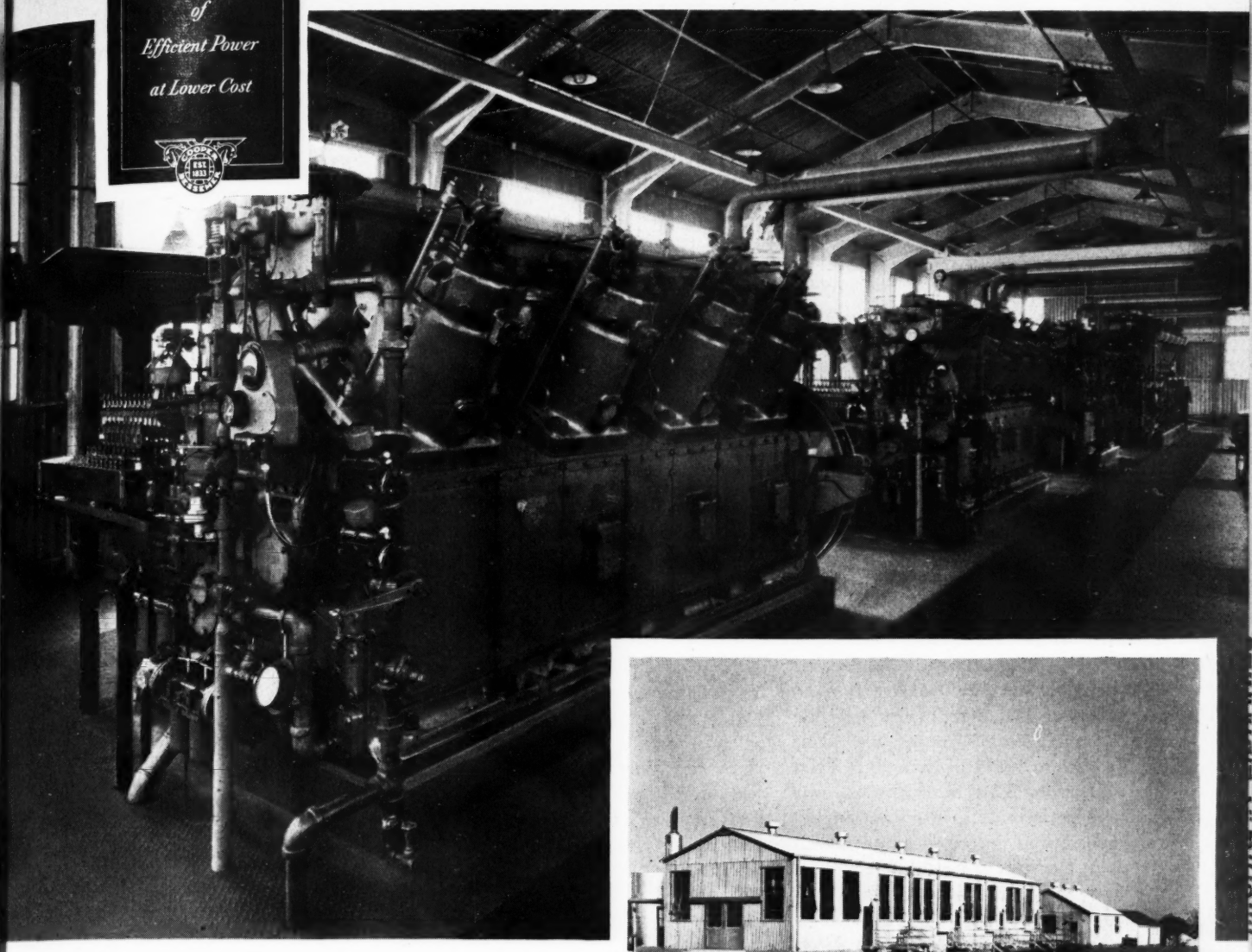

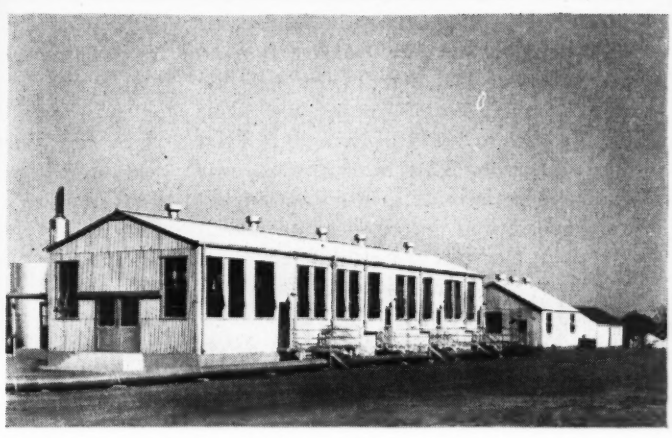

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THE answer to efficient, low-cost compressor service at Lone Star Gas Company's gasoline extraction plant in the Katie Field is this 2,560-horsepower line-up of Cooper-Bessemer V-angles. These units, 3 GMX's and a GMV, compress casinghead and low pressure distillate gas from about 60 psi suction to 415 psi discharge, for delivery to the absorber.

Of particular interest, the engines have automatic speed control and drive compressor cylinders selected for a wide range of operation without the use of unloading equipment. Add to this the fact that every *crankthrow*, all down the line, drives a compressor cylinder. Here's an economical, easy-to-maintain setup that makes the most of Cooper-Bessemer V-angle compactness.

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3. But this drop is not too severe. And economically, the loss is less than the loss which otherwise would occur from shutting down a 10- to 12-mile valve section of the mainline to do the same job without the dual block valve installation.

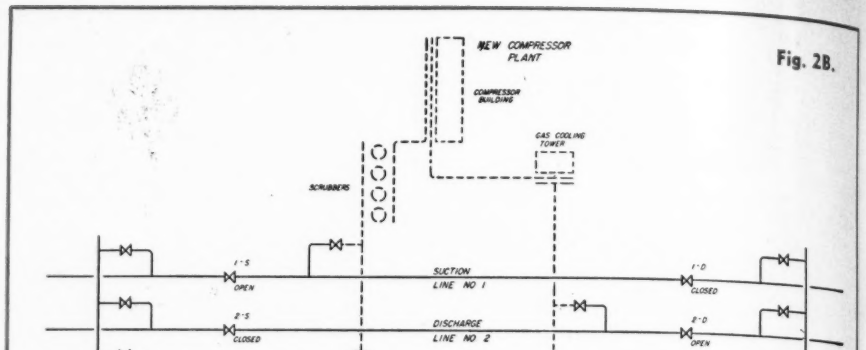
Proceeding in a similar manner, Line No. 3 is shut down between the 1 block valves, and the other suction valve for the new plant is set. When this is done, the same process is repeated on Lines 2 and 4 setting the new discharge tie-ins for the new compressor facilities. All mainline work in the plant yard, either the tie-in of new compressor facilities, maintenance, or repair, can be accomplished by taking the affected line out of service. The work can be done safely and without serious reduction of the pipeline system capacity.

Under this system, no longer do the scrubbers have to be located on the upstream side and the cooling tower on the downstream side of a single mainline block valve. They can now be located anywhere between the block valves irrespective of the direction of mainline flow, without complicating the plant piping pattern, and still have a good tie-in connection. This flexibility permits much more latitude in the location, arrangement, and interconnection of all the plant facilities, since the direction of the flow in the mainline can be disregarded.

To by-pass the plant, it is only necessary to open the four closed mainline block valves. This makes each pipeline a thoroughfare line through the plant. The plant may be isolated from the mainline and blown down if desired by closing the suction and discharge valves for the individual compressor buildings.

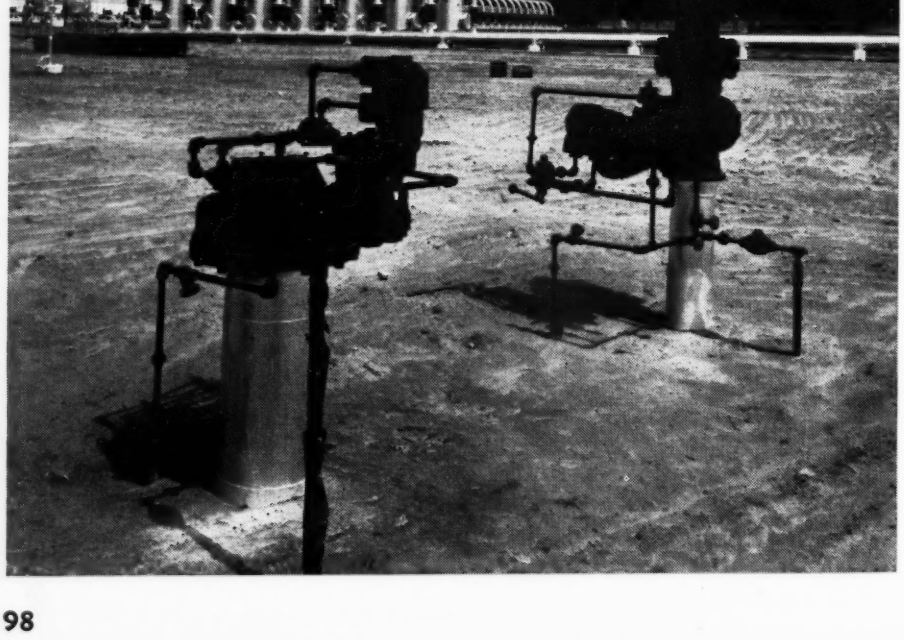
It is not planned that there ever will be more than four lines laid across the plant yard. Any fifth line loop would be tied into the suction and discharge manifolds only, and not continued across the plant yard. The manifold must be taken out of service to extend it for the tie-in, and while it is out of service, two pipelines will be blocked off from the plant. But they will be out of service only to the next mainline valve installation where cross-overs are installed. While a slight operating curtailment will result from taking two valve sections out of service, no blow-down of these lines is needed and no appreciable gas loss will result from the tie-in.

Fig. 2B.



A simple, reliable remote control system to shut down the plant in an emergency has been made possible by this piping arrangement. Note from *Fig. 2A* that all gas enters the plant through two valves, the mainline suction block valves marked 1-S and 3-S; and that likewise all gas leaves the plant through two valves, the mainline discharge block valves marked 2-D and 4-D. Closing these four valves completely isolates the compressor plant from the pipeline. Since closing only four valves will isolate the plant, only four valve operators are required under this piping system as compared to a possible 32 operators in the previous system. Thus it will be much simpler to maintain the operators in an operable condition, and the possibility of an operator failing to work will be correspondingly reduced. Even if one of the four operators fails to perform, the operator-equipped valves (*Fig. A*) can still be reached to be manually closed without danger to the personnel because these valves are located at the extreme limits of the plant site, usually a distance of 1500 to 2000 ft apart. Each mainline is equipped with an 8-in. blow-off valve (*Fig. B*) which is operator-equipped. These blow-off valves are connected to the control piping in parallel with the operator-equipped mainline block valves. Thus these blow-off valves start opening as the mainline valves begin closing and the plant blow-down is started immediately upon activation of the control system.

Fig. A. Operator-equipped valve **Fig. B. Blow-off valve**



Valve operators available at the time the remote control system was designed were rejected because of various control features or mechanical problems which were considered detrimental to reliable operation. At Tennessee's request, two operator equipment manufacturers designed a new style valve operator consisting of a 1000 psi working pressure, high-speed, vane-type gas motor which, through a set of reduction gears, drives the hand wheel shaft of the valve. This drive is positive throughout with no declutching arrangements. Limit valves to shut off the gas supply when the valve has reached the closed position are a glove or slide type valve, spring loaded in the open position and closed by a cam which is mounted either on the main plug shaft of the valves or driven through a set of reduction gears from the valve hand wheel shaft. These limit valves are spring loaded in the open position so that they cannot be manually closed and left closed through oversight or neglect. A 5-way manually operated reversing valve is provided to reverse the direction of valve travel. This 5-way valve is spring loaded in the emergency-run position, i.e., to close the mainline valve and to open the blow-off valve so that this valve cannot be left in the wrong position. The operators will close the mainline block valves in from 10 to 15 seconds and will open the blow-off valves in about 5 seconds. The plant can be shut down and blown down in approximately 2 minutes.

The remote control piping system is illustrated in *Fig. 3*. Gas supply is obtained by a tap on the discharge manifold to use the highest pressure available and then through a 1½-in. supply line is conducted into storage bottles through a check valve. The check valve is to insure against a pipeline failure that will bleed off the gas reserve necessary to operate the remote control system. A line from the storage bottles then goes to a manually operated valve which is normally closed. This valve is the system's activating valve and is called the remote control valve (*Fig. C*). The system to this point is always pressurized. From this valve the gas is piped to the four mainline valve operators and the four blow-off valve operators all of which are connected in parallel. Opening the remote control valve admits gas to all operators at the same time and there are no other valves between the remote control valve and the operators which can be left closed accidentally or otherwise.

Three additional safety features are incorporated in the remote control system to prevent an excessive pressure build up on the discharge side of the engines in the event the blow-off on the discharge side of the plant fails to open as the discharge block valves are closed.

The first of these are two 8-in. relief valves mounted on the mainline discharge lines before the block valves which provide sufficient capacity to relieve the pumping capacity ability on all the engines. The second safety feature consists of relief valves mounted on the discharge side of each individual compressor engine and the third feature is a shutdown system to shut off the compressor engine ignition which is fed from the main plant switchboard through rectifiers. This system is activated in the following manner:

A Mercoid switch is mounted on the remote control piping system on the outlet side of the remote control valve. The same gas pressure which operates the mainline valves and blow-off valves will close the Mercoid switch. An electric circuit fed from the 440-volt, 3-phase main plant bus is completed through the Mercoid switch and energizes trip coils installed in the main switchboard circuit breakers which supply the compressor engine ignition system. As these circuit breakers are tripped, all of the compressor engines in the plant are shut down.

Additional safety precautions to help prevent the possibility of fire in the event of escaping gas in or near the compressor building consist of additional trip coils mounted on the circuit breakers which supply all of the light and power to the compressor building. Thus all electrical wiring in the compressor building is de-energized when the remote control system is activated. These circuit breakers are all equipped with dead-man type by-pass switches so that the performance of these breakers may be periodically checked without shutting down the plant. Since these switches are spring loaded in the off position, they cannot be left in a position to by-pass the breakers and make the safety precaution inoperable.

In a multiple pipeline system it is very difficult to determine which line has failed at the compressor station since the lines are all equalized at the plant. Tennessee normally operates its system with the cross-over lines closed at its mainline valve settings. Therefore, pressure is equalized only at the compressor station.

Fig. C. Remote control valve

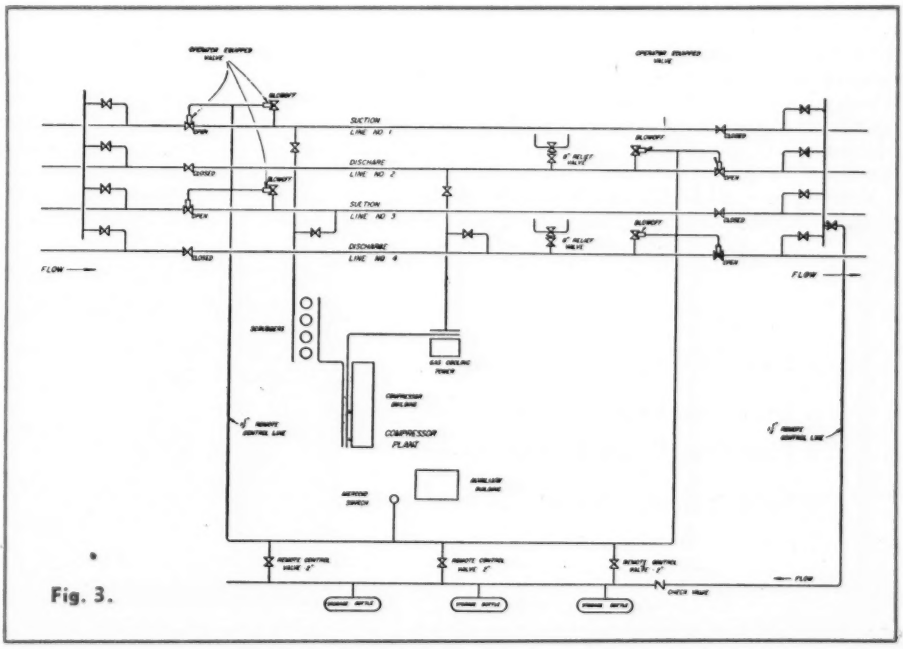


Fig. 3.

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Gauges are mounted on each pipeline on the pipeline side of the suction and discharge manifolds. In the event of an emergency or pipeline failure on the mainline, each line can be successively closed off from the plant and manifold and by watching the action of the pressures shown on the gauges, the leaking line can be quickly isolated from the system. Other lines and the plant can remain in service. Also Tennessee's compressor stations are equipped with a sound-powered telephone intercommunication system.

Where materials were obtainable, in repiping Tennessee Gas' compressor stations as outlined, all pipe fittings, valves, etc. subject to high pressure gas were installed to conform to the ASA B31.1 Code for Pressure Piping, to Division 1 standards of Section 2 of the code, or better. For plants operating at 760 psi discharge, all large-diameter high-gas-pressure gas pipe in the plant yard was either installed or relaid to the following wall thicknesses and diameters: ½-in. wall thickness x 24-in.; ⅝-in. wall thickness x 26-in.; and ⅞-in. wall thickness by 30-in. Since the production pipe mills do not normally make pipe in wall thickness greater than ½ in. in these sizes, it was necessary for a considerable portion of the pipe to be manufactured by fabricators. This pipe being non-expanded, was all stress-relieved and hydraulically tested. A new line of fittings was designed and manufactured to make the required connections possible. All the materials in both the pipe and fittings were at least 42,000 psi minimum yield material and all wall thicknesses were specified as minimum instead of nominal to obtain full strength throughout all fittings and pipe.

An actual plant piped by this method, Tennessee Gas' compressor station No. 8 *(Fig. 4)* near Batesville, Miss., is shown in the isomatic drawing thus labelled. Tennessee Gas plants all have been repiped to this system and the blow-down remote control system installed at each within the last two years. Some welding saddles and a small amount of light weight pipe remain to be removed and replaced with specification material. The remainder of this work will be completed in the 1952 construction season. All basic elements of the manifold system are now installed, however.

For the first compressor building installation and the initial pipeline construction, it is not necessary to install the four pipelines across the plant yard, but only that part which will carry out the required design considerations. The various steps in which this system may be considered are shown in *Figs. 5A-5C,* but comparative cost will be considerably less than construction by the conventional system by the time the installation has reached a size of three compressor buildings and three pipelines.

Fig. 4.

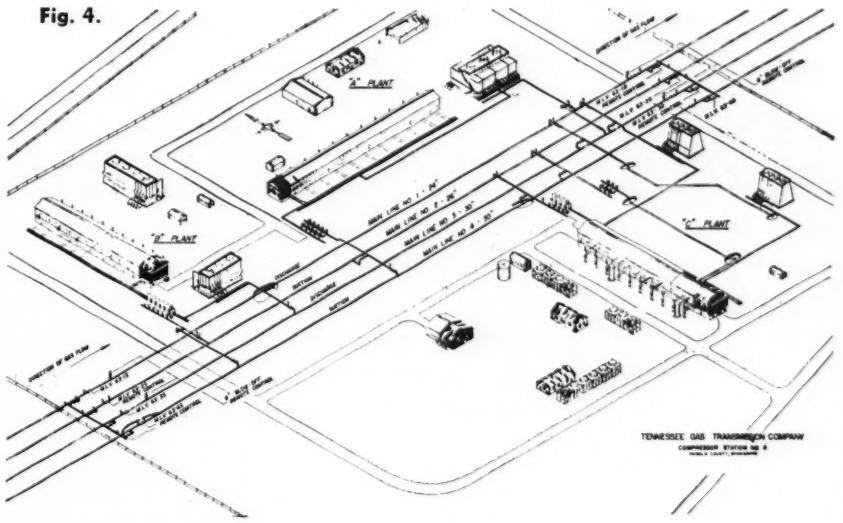


Fig. 5A.

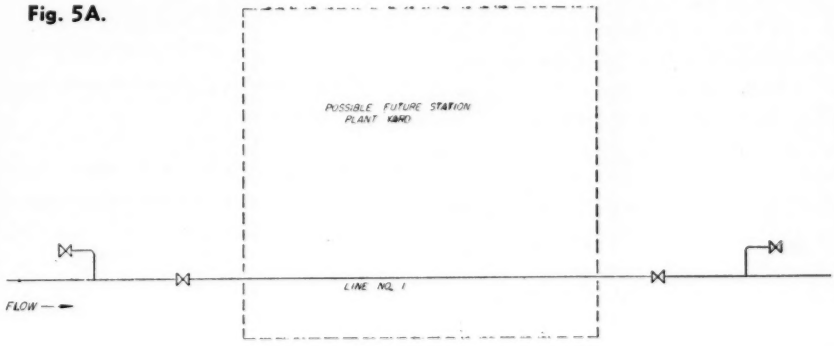


Fig. 5B.

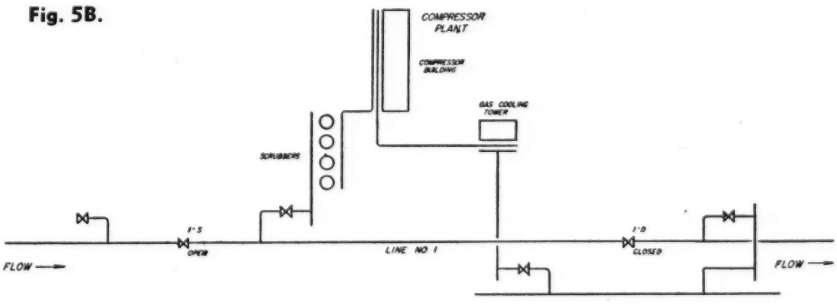
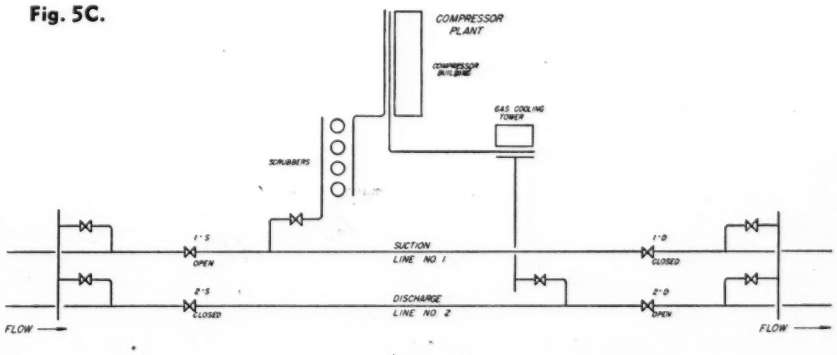


Fig. 5C.



Designing Pipeline Spans

Analysis of added stresses inherent in unsupported spans led to the construction of open span pipe crossings that shaved costs without any sacrifice in safety factors.

By PHILIP E. REYNOLDS
Pacific Gas & Electric Co.
San Francisco

EXCEPT for tell-tale contour disturbances which are obvious to the pipeline operator and contractor, the usual gas transmission main is a buried pipeline hidden from the sight of the general public. While electric transmission tower lines span from hilltop to hilltop, and telephone cables cling close to highways and railroads, the large gas main is usually tucked into a private right-of-way that follows the shortest route from beginning to end without fuss or bother. Occasionally the public will see a short length of exposed pipe spanning a ravine or paralleling a bridge at a stream, but otherwise the pipeline is unrecognized and unobserved.

However, as pipelines have become larger they have become more difficult to hide. Right-of-way benching remains as an unexplained "old road" to the public. Valve installations become large and obvious. Compressor station installations become more numerous and complex, resulting in larger buildings, more piping, and more public attention. And frequently along the pipeline right-of-way more open span pipe construction in crossing streams, gullies, or ravines may be advantageous.

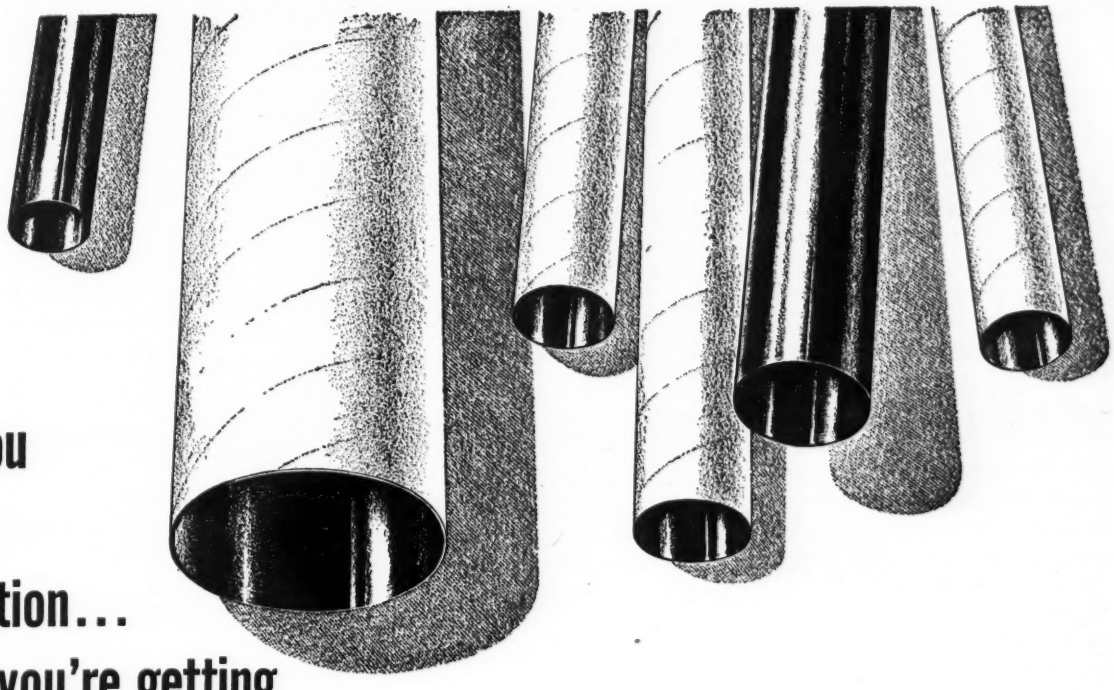
With the increase in size and length of pipelines, more and more attention has been directed toward ways of increasing the capacity of a main without increasing the capital cost. The most direct way to keep the capital cost of a project to a minimum is to reduce or limit the amount of material that is required to be purchased, processed, transported and installed. As a result, the trend in pipeline construction, particularly in the large diameter cross-country pipelines, is to seek out and use higher strength steels for the pipeline material. This allows an increase in gas working pressures, and, as a result, gives more pipeline capacity per ton of steel used, which nets a saving in capital cost per unit of capacity even though the higher strength steel may require premium payments which result in a higher unit cost.

Hand in hand with the use of higher strength steels has been the continued trend in economy of pipeline construction. Bigger and faster trenching machines have been built. Equipment for handling and installing pipe has been improved. And the construction people have become increasingly aware of economies that can result from different pipe installation techniques under different pipeline right-of-way conditions.

It was early in the construction planning for the Pacific Gas & Electric Co.'s 34-in. Topock-Milpitas (Calif.) gas main that it was realized that economies would result if open span pipe crossings could be used where conditions would allow. In some areas of the desert, gullies existed which were susceptible to cloudbursts and flash flood runoffs. In mountainous areas, creeks and canyons were an inescapable problem of the right-of-way. In order to maintain a direct pipeline route, many of these gullies and canyons could not be avoided. Any location where an overhead span could be installed in place of a buried crossing appeared to offer an economy in pipeline construction. And the ultimate savings in the elimination of buried pipeline maintenance and repair costs at stream crossings appeared to be desirable.

Presented at the PCGA transmission conference in Berkeley, Calif., April 2-3.

As the result of studies made by PG&E, open span construction was employed in a number of locations along the Topock-to-Milpitas "Super Inch" line.



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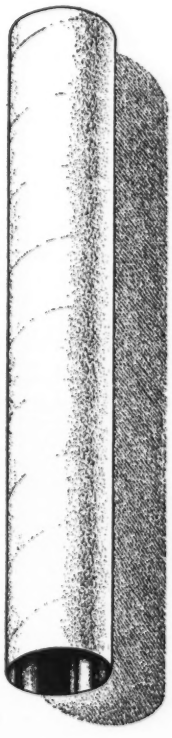

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TABLE 1. Ultimate Strength of 34-in. Pipe

	Min. Yield Strength	Min. Ult. Strength
Wall thickness up to and including 3/8 in.	52000 psi	72000 psi
Wall thickness greater than 3/8 to 7/16 in.	48000	65000
Wall thickness greater than 7/16 to 1/2 in.	46000	65000

As was mentioned before, the trend in large diameter pipeline construction has been toward the use of higher strength steels. This practice has been followed in conformance to certain codes which have been accepted by the industry. Probably the most widely adopted code for the design of cross-country gas transmission mains has been the American Standard Code for Pressure Piping (ASA B31.1-1951). Section 2 of this code prescribes design standards for gas and air piping, while Division 2 of Section 2 applies particularly to cross-country transmission mains which pass through sparsely populated or rural territories.

The ASA Code lists the maximum allowable values of stress due to the internal pressure for steel pipe fabricated according to various specifications. The code also outlines the maximum allowable values of stress and gas working pressure for pipe which is manufactured to some specification other than those listed. Since the higher strength pipes used for the present day large diameter mains fall into this second category, any consideration of pipeline span design must determine what is the allowable value of maximum stresses which will limit the design.

Pipe Specifications

In order to develop this application we shall use specifications for the pipe which was installed on the Pacific Gas & Electric Co. 34-in. Topock-Milpitas gas main as an example. This pipe was purchased to a specification proposed by the Consolidated Western Steel Corp. The pipe is an electric fusion welded product, fabricated from steel made by the open hearth process, with certain limiting values of allowable chemical composition of the steel. The specified transverse yield strength of the pipe was obtained by cold working the steel with internal pressure, expanding the steel to specified size. The resulting pipe had a minimum transverse elongation (in 2 in.) of 22% and a minimum transverse yield strength and ultimate strength (according to the pipe wall thickness) as shown in *Table 1*.

The expanded steel pipe which was obtained was made from mill rolled plates which had a yield strength of 40,000 psi or more before undergoing the cold working expansion process. Since in the analysis of pipe span stresses which is to follow, the longitudinal yield strength of the pipe also becomes an important factor, the assumption is made that the expansion process cold works the pipe only in the transverse direction, and that the longitudinal yield strength remains the same as that of the original unworked plate.

Additional Test

The one further physical test necessary on this pipe in order to establish the maximum allowable gas working pressure for the pipeline is the mill hydrostatic test. Section 2 of the ASA Code for pressure pipe provides that the mill test pressure which can be specified is to be based upon the formula

$$P_m = \frac{NKT}{D}$$

where P_m = mill test pressure in psig.

N = a numerical factor, which for the 34-in. pipe herein used as an example can be taken at the maximum allowable value of 1.80.

K = stipulated minimum effective yield strength in psig.

T = nominal or specified pipe wall thickness in inches.

D = nominal or specified outside diameter of pipe in inches.

The calculation is equivalent to basing the maximum allowable mill test pressure on a stress that is equal to 90% of the minimum specified transverse yield strength of the pipe.

With the pipe specified and obtained as above, then the ASA Code for Pressure Piping allows the pipeline to be operated at a maximum allowable working pressure within the scope of Division 2 at 80% of the mill test pressure. This resolves to a maximum operating pressure which develops a stress of 72% of the specified minimum yield strength of the pipe. (Or, converted into a factor of safety based upon the yield strength of the pipe, it resolves to a minimum design factor of safety of 1.39.)

A casual observation will show that if a pipeline is designed to operate at the maximum allowable working pressure for its buried sections, then any spans made of the same pipe as that used in the buried sections will have a lower factor of safety because of the added stresses resulting from the span. Hence, in order to design a pipeline span properly, it becomes necessary to analyze the stresses which might be expected to occur in such a structure and then develop an allowable span structure with adequate factor of safety matching that of the rest of the pipeline system. The economics of engineering design would rule that the span structure should be as strong as the balance of the pipeline when all contributing influences are evaluated.

Stresses which occur in a pipeline span can be listed as follows:

1. Tranverse tensile stress due to internal pressure.
2. Longitudinal tensile stress due to internal pressure.
3. Longitudinal compressive or tensile stress due to temperature change.
4. Longitudinal bending stresses (tensile and compressive) due to beam loading of the pipe in the span.

The first three stress conditions are common both to spans and buried pipe sections, although to a different degree because of differing conditions that occur.

Internal Pressure — Transverse Tensile Stresses

The common method for calculating the transverse tensile stress due to internal pressure on pipe is the Barlow formula. Two accepted variations are recognized. The first is based upon the assumption that the maximum stress occurs at the outside diameter of the pipe (see American Standard Code for Pressure Piping, ASA B31.1-1951). The second, where the shell thickness does not exceed 10% of the radius, is based upon the assumption that the maximum stress occurs at the inside diameter (see API-ASME Code for Unfired Pressure Vessels-1934). While the second method is possibly a more accurate calculation of the transverse stress the first method is more severe and hence gives a more conservative comparison when studies are made of the calculated factor of safety. In this application, since we are referring to the ASA Code for Pressure Piping for allowable limits of stress, we will use the ASA procedure for determining the calculated transverse tensile stress in the pipe.

$$S_1 = \frac{PD}{2t}$$

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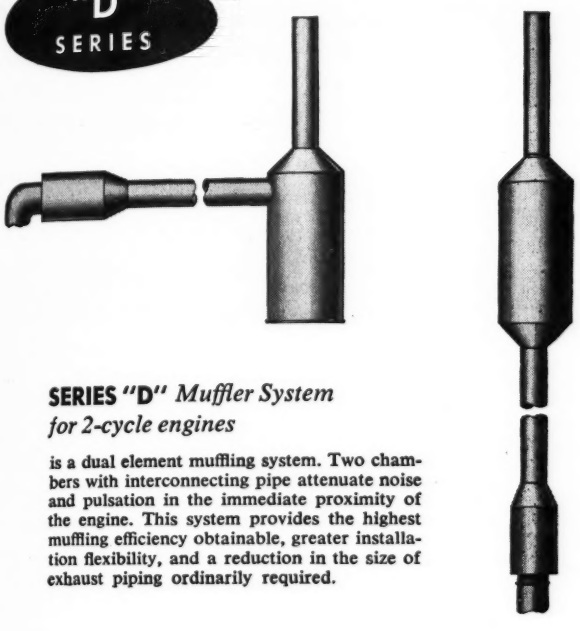

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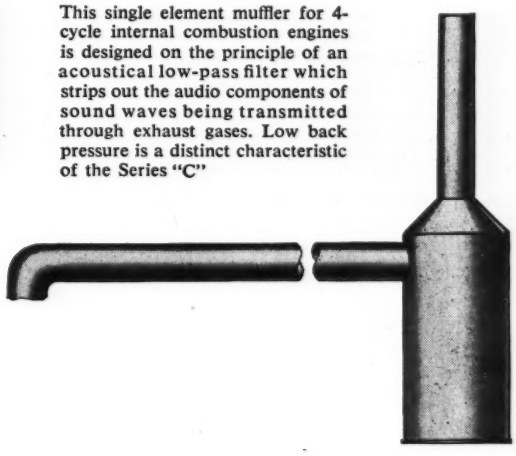

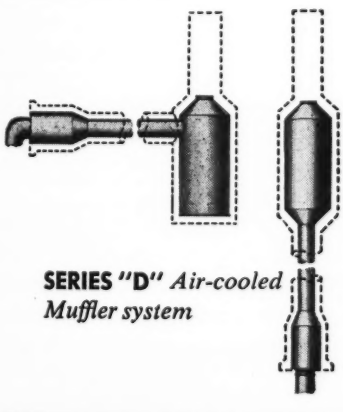

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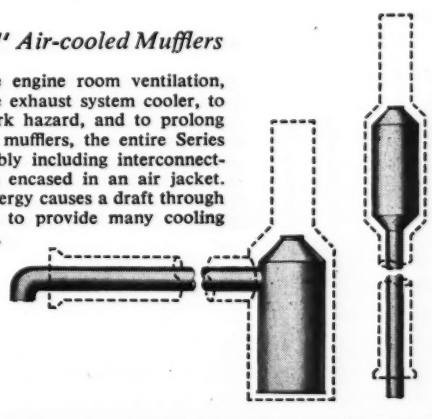

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Where S_1 = transverse tensile stress due to internal pressure, psi.
P = internal gas pressure, psig.
D = outside diameter of pipe, in inches.
t = nominal wall thickness of pipe, in inches.

The longitudinal tensile stress due to internal pressure is calculated as the longitudinal strain resulting from the transverse tensile stress due to the internal pressure. This is obtained by multiplying the transverse tensile stress by Poisson's ratio, which for steel is taken as 0.3. Such an analysis applies to the calculation of the longitudinal stress in an open-end container, such as exists with the pipeline spans, and differs from the longitudinal stress that occurs in a short length closed-end container where the end thrust on the closed ends develops a longitudinal stress of one-half the transverse tensile stress.

$$S_2 = 0.30 \times S_1$$

Temperature Stresses

The longitudinal stress resulting from temperature change is due to the restraint of expansion movement resulting from temperature change, and is calculated as

$$S_3 = CE\ (t_2 - t_1) \text{ or, for steel,}$$
$$S_3 = 195\ (t_2 - t_1)$$

where S_3 = longitudinal stress due to temperature change, psi.
$(t_2 - t_1)$ = temperature change, ° F.
C = coefficient of thermal expansion of steel (6.5×10^{-6}).
E = modulus of elasticity of steel (30×10^6).

Where the temperature change is an increase, then the longitudinal stress in the pipe section is compressive. Where the temperature change is a decrease, then the longitudinal pipe stress is tensile.

The longitudinal bending stresses due to beam loading are calculated on the assumption that the pipe section corresponds to a uniformly loaded beam. For either unsupported or supported span conditions, the beam is similar to the fixed-end condition for which the theoretical calculation for bending stresses (tensile and compressive) is derived as

$$S_b = \pm \frac{1}{12} \frac{WL^2Y}{I}$$

where S_b = longitudinal stress due to beam loading, psi.
W = beam loading in pounds per inch.
L = span length in inches.
Y = pipe radius in inches.
I = moment of inertia of the transverse pipe section in $(\text{inches})^4$.

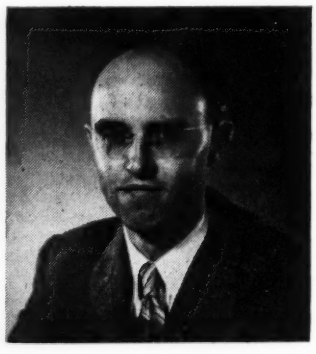
For the application to analysis of pipeline spans, this theoretical calculation has been modified to

$$S_4 = \pm \frac{1}{10} \frac{WL^2Y}{I}$$

This modification is made to offset uncertainties in span construction. During actual construction, positive attempts should be made to obtain firm bearing soil at the end points of a span. However, it is considered doubtful that the point of tangency of the pipeline span will occur at the banks of the span crossing, but rather back into the banks some distance. In order to be safe in this respect, it is suggested that the length of the span be measured from the points of entrance of the pipe span into the banks, irrespective of the exact location of firm bearing soil, and the modification be made in the factor of the stress formula to compensate for the more exact theoretical length of a fixed end span.

This modification is a compromise between the factor 1/12 in the fixed-end beam formula and the factor ⅛ in the free-end beam formula. It has the net effect of locating the firm bearing soil support points in the banks of ravines back a distance of about 8% of the span length, or about 4% at each end.

When the beam loading of the span is being determined, all factors contributing to this loading should be considered. These include the weight per foot of the pipe, the weight of the compressed gas, and the horizontal wind loading on the pipe. The vertical and horizontal loadings should be combined as the vector sum to obtain the resultant loading to be used to calculate the beam bending stresses.



Mr. Reynolds, assistant engineer in PG&E department of gas transmission and distribution, was graduated from the University of California in 1940 with a B.S. degree in electrical engineering. Before joining PG &E in 1945, he worked as a test and design engineer in turbine thermodynamic designing for General Electric.

Safety Design

The calculations for the separate components of the stress loading in a span, as briefed above, are relatively simple and straightforward. However, the combining of these various stresses into a net resultant stress which determines the factor of safety of the design is a more difficult analysis. As can be seen, certain of these stresses are transverse to the pipe, while others are longitudinal. And in addition there is the plus-and-minus combination of tensile and compressive stresses. Complicating this situation in the case of expanded steel pipe, such as that used on the Topock-Milpitas gas main, is the difference in yield strength of the pipe material in the transverse and longitudinal directions.

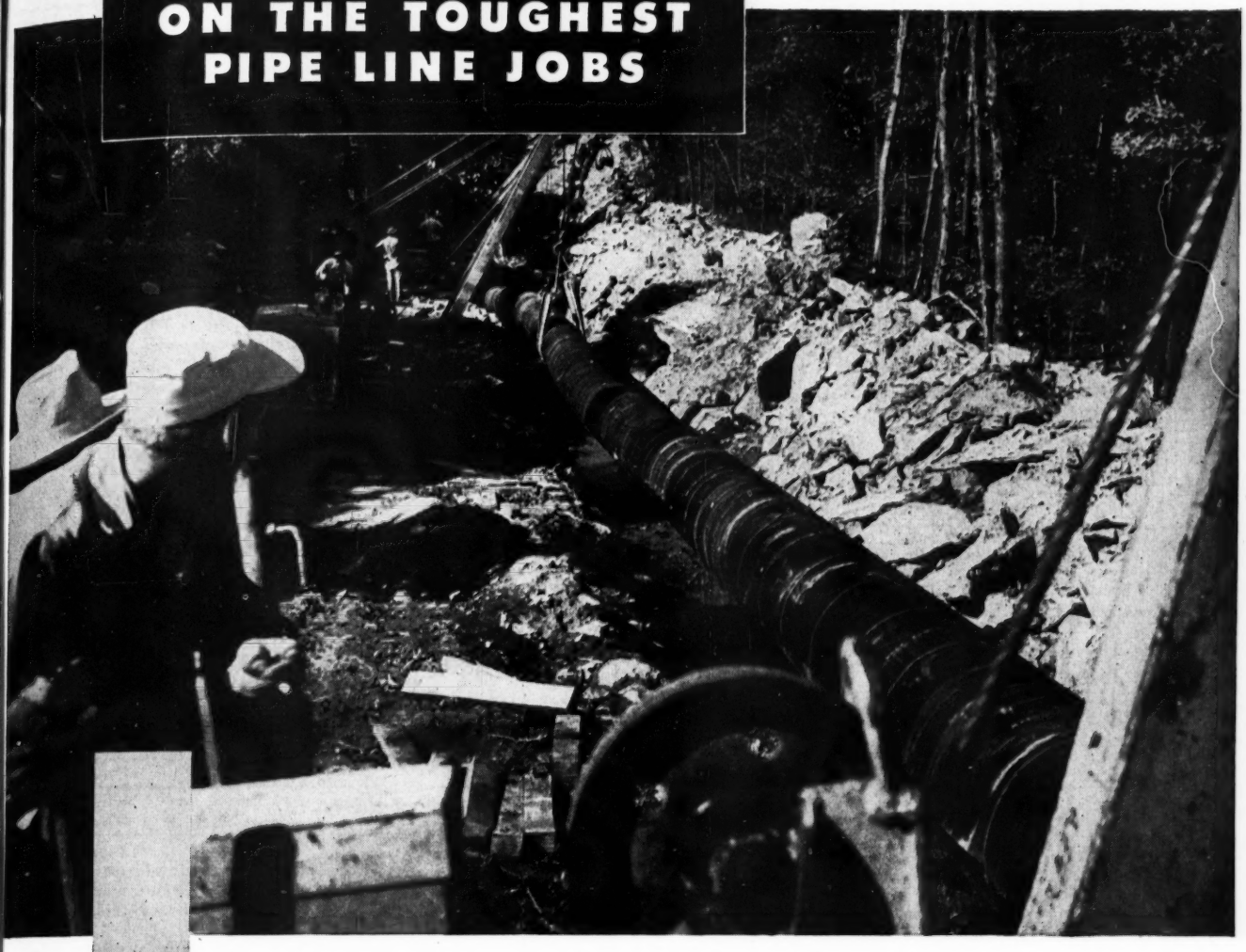
Test information[1] and studies[2] have shown that when a plate is stressed by tensions at right angles to each other, the allowable stresses in the two directions will be somewhat higher than if the plate were stressed in one direction only. Similarly, if a compression stress acts at right angles to a tension stress, the allowable value of the tension stress must be reduced because of the presence of the compressive stress. The result of these phenomena is that the analysis of the combined stresses occurring in a pipe span must recognize that any longitudinal compressive stress will reduce the transverse (or circumferential) yield strength of the pipe.

As a result of studies of the phenomena, an equation has been developed[2] which mathematically describes the variation of the allowable tension stress under conditions of tension or compression stresses occurring at right angles to the primary stress. This equation is

$$x^2 - xy + y^2 = 1$$

where the y coordinate is the primary stress (in our application the transverse yield strength of the pipe) and the x coordinate is the right angle stress (in our application the longitudinal stress in the pipe). *Fig. 1* shows this equation plotted for the particular yield strength constants which apply to the expanded steel

ON THE TOUGHEST PIPE LINE JOBS



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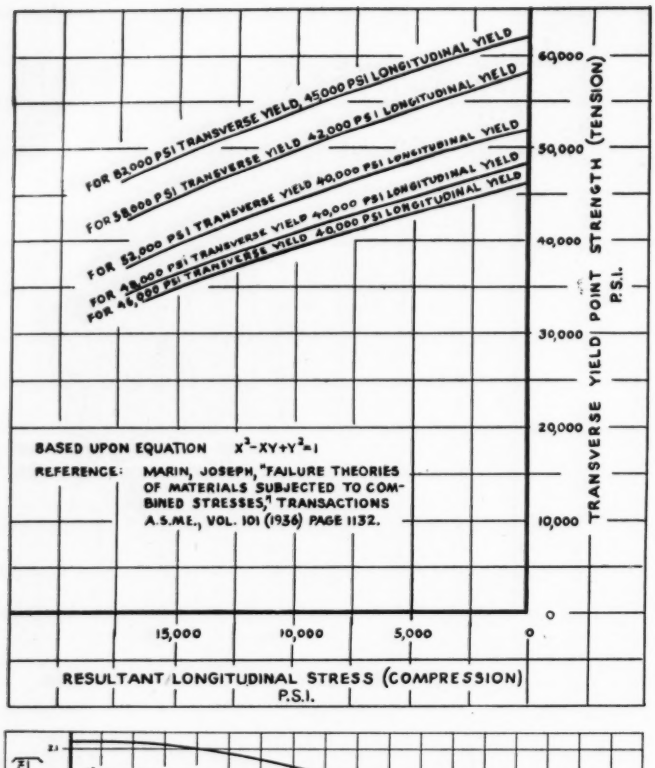
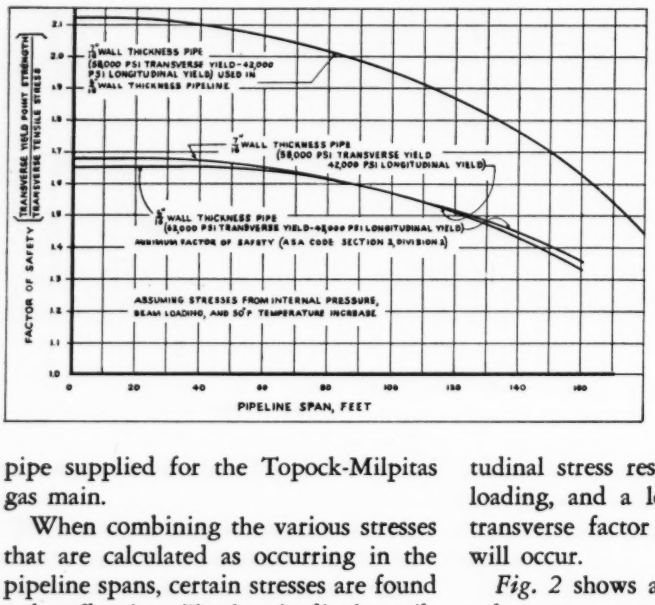

FOR 52,000 PSI TRANSVERSE YIELD, 45,000 PSI LONGITUDINAL YIELD
FOR 50,000 PSI TRANSVERSE YIELD 42,000 PSI LONGITUDINAL YIELD
FOR 52,000 PSI TRANSVERSE YIELD 40,000 PSI LONGITUDINAL YIELD
FOR 48,000 PSI TRANSVERSE YIELD 40,000 PSI LONGITUDINAL YIELD
FOR 46,000 PSI TRANSVERSE YIELD 40,000 PSI LONGITUDINAL YIELD
BASED UPON EQUATION $X^2-XY+Y^2=1$
REFERENCE: MARIN, JOSEPH, "FAILURE THEORIES OF MATERIALS SUBJECTED TO COMBINED STRESSES," TRANSACTIONS A.S.M.E., VOL. 101 (1936) PAGE 1132.
TRANSVERSE YIELD POINT STRENGTH (TENSION) P.S.I.
60,000
50,000
40,000
30,000
20,000
10,000
0
15,000
10,000
5,000
0
RESULTANT LONGITUDINAL STRESS (COMPRESSION) P.S.I.


FACTOR OF SAFETY (TRANSVERSE YIELD POINT STRENGTH / TRANSVERSE TENSILE STRESS)
WALL THICKNESS PIPE (52,000 PSI TRANSVERSE YIELD - 42,000 PSI LONGITUDINAL YIELD) USED IN WALL THICKNESS PIPELINE
WALL THICKNESS PIPE (52,000 PSI TRANSVERSE YIELD 42,000 PSI LONGITUDINAL YIELD)
WALL THICKNESS PIPE (52,000 PSI TRANSVERSE YIELD-42,000 PSI LONGITUDINAL YIELD)
MINIMUM FACTOR OF SAFETY (ASA CODE SECTION 2, DIVISION 2)
ASSUMING STRESSES FROM INTERNAL PRESSURE, BEAM LOADING, AND 50° F TEMPERATURE INCREASE
PIPELINE SPAN, FEET

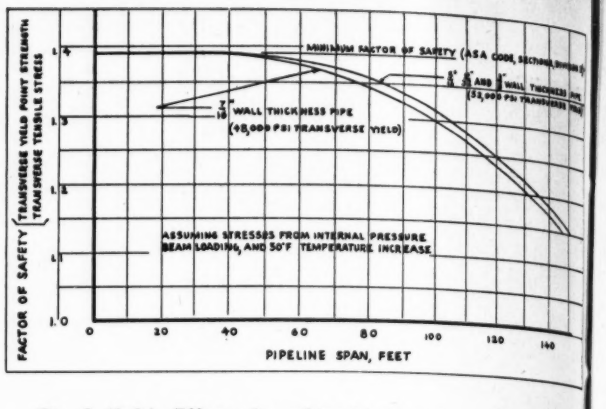

FACTOR OF SAFETY (TRANSVERSE YIELD POINT STRENGTH / TRANSVERSE TENSILE STRESS)
WALL THICKNESS PIPE (52,000 PSI TRANSVERSE YIELD)
ASSUMING STRESSES FROM INTERNAL PRESSURE, BEAM LOADING, AND 50° F TEMPERATURE INCREASE
PIPELINE SPAN, FEET

Fig. 1 (left). Effect of combined transverse and longitudinal stresses on yield point strength of pipe.

Fig. 2 (above). Factor of safety vs. span length for 34-in. OD high strength steel pipe.

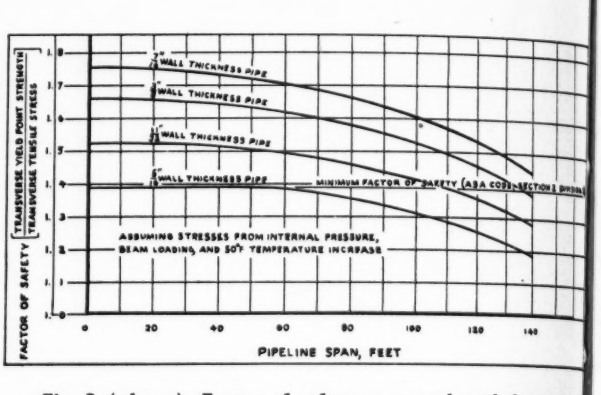

FACTOR OF SAFETY (TRANSVERSE YIELD POINT STRENGTH / TRANSVERSE TENSILE STRESS)
WALL THICKNESS PIPE
WALL THICKNESS PIPE
WALL THICKNESS PIPE
WALL THICKNESS PIPE
ASSUMING STRESSES FROM INTERNAL PRESSURE, BEAM LOADING, AND 50° F TEMPERATURE INCREASE
PIPELINE SPAN, FEET

Fig. 3 (above). Factor of safety vs. span length for 34-in. OD high strength steel pipe using various wall thickness pipe in spans on 5/16-in. wall thickness pipeline.

Fig. 4 (left). Factor of safety vs. span length for 34-in. OD high strength steel pipe using selected high physical test pipe in spans.

pipe supplied for the Topock-Milpitas gas main.

When combining the various stresses that are calculated as occurring in the pipeline spans, certain stresses are found to be offsetting. The longitudinal *tensile* stress due to pressure in the pipe happens to be equal approximately to the longitudinal *compression* stress resulting from a 50° F temperature rise. At this condition this cancellation effectively eliminates all the longitudinal stresses except for those resulting from the beam bending stress. When combining the various stresses, it goes almost without saying that the designer must evaluate all possible combinations of pressure, temperature, and loading which may occur at a particular span and determine the resulting allowable span length accordingly. For conditions where the temperature change is a decrease, the resultant longitudinal stress is tensile. The combined longitudinal tensile stresses then tend to offset the compressive longitudinal stress resulting from the beam loading, and a lesser reduction in the transverse factor of safety of the pipe will occur.

Fig. 2 shows a plot of the factor of safety versus span length for the 34-in. OD pipe of various wall thicknesses which was purchased for the Topock-Milpitas gas main. This plot is based upon gas working pressures which develop a transverse tensile stress of 72% of the yield strength of the pipe (maximum allowable according to Division 2, Section 2, ASA Code for Pressure Piping) and upon an assumed maximum temperature increase of the span of 50° F. The effect of the increasing magnitude of the compressive longitudinal stress resulting from increased length of span can be seen in the plotted decrease in factor of safety as the span length increases. It is obvious from this chart that only comparatively short spans can be allowed in a pipeline of this design without introducing weak points which seriously lower the factor of safety of the pipeline.

Now that a method of analysis has been developed which provides a procedure for combining the various stresses occurring in a pipeline span, studies can be made of various alternate span designs which might be suggested to increase the length of allowable spans. One such proposal might be the use of heavier wall thickness pipe in the span sections. *Fig. 3* shows the results of such a study. The chart again uses the 34-in. OD pipe and in this case applies to the use of increased wall thickness pipe in spans which would occur in a basic 5/16-in. wall thickness section of the pipeline. A similar assumption to that of *Fig. 2* was made for the temperature increase of 50° F at the span. With thicker wall pipe used in this manner at the spans, the analysis shows that for a particular span length the net compressive stress obtained after combining the calculated longitudinal stresses due to internal pressure, temp

ature, and beam loading is greater than when the pipe is operating at higher pressures. As a result the transverse yield point strength of the pipe in the span is less. However, since it is a heavier wall section of pipe, the actual transverse tensile stress due to internal pressure is less in proportion, so that an increase in factor of safety results.

Same Results

The same beneficial results can be shown for any portion of the pipeline, no matter what the basic wall thickness for the pipeline section might be. In the case of the 34 in. x 7/16 in. or ½ in. wall pipe, a decreased benefit results because of the lower value of the minimum specified transverse yield strength of the pipe which we are using for an example. However, this study shows that spans up to 140 ft might be considered acceptable using 34 in. x 7/16 in. wall thickness pipe in the 34 in. x 5/16 in. pipeline section, without incurring a factor of safety at the span which is less than that of the buried pipeline section.

Another span design which might be suggested in order to obtain an increased length of allowable span could be the use of pipe which physical tests have shown to be of better quality than the minimum standards that the pipe specifications have required. Experience with the 34-in. pipe on the Topock-Milpitas pipeline has shown that on frequent occasion pipe will be obtained with physical strengths considerably above the minimum values established in the specifications. *Fig. 4* shows the results of such a study where it has been assumed that pipe with higher values of transverse yield strength and longitudinal yield strength was available. As in the previous charts, a temperature increase of 50° F at the span has been used. Also the internal pressure corresponding to 72% of the minimum specified transverse yield strength of the pipeline section has been used (maximum allowable according to Division 2, Section 2, ASA Code for Pressure Piping). This study shows that spans up to 150 ft might be considered acceptable using the same wall thickness of pipe for the spans in a pipeline section when the pipe is selected especially for this application.

As might be expected, a combined study of the use of heavier wall thickness pipe and higher-than-average physical test pipe will show a further increase in the allowable length of pipeline span. This is indicated by the curve for 7/16-in. wall thickness pipe used in a 5/16-in. wall section pipeline which is shown in *Fig. 4*.

In conclusion, perhaps two precautionary comments should be made. The first is that this method of analysis of pipeline span design should not be considered as the only analytical study which is necessary when designing spans. All mention of supported spans has been intentionally omitted since other factors in addition to those which have been presented here enter into the design studies when supports are being considered. In addition we have said nothing about the magnitude of longitudinal compressive stresses which might be considered limiting in this pipeline span design. In the application to the 34-in. Topock-Milpitas pipeline we have considered this stress to be limiting at values of about 20,000 psi, or a factor of safety of 2 based upon the longitudinal yield strength of the pipe. In this application this was a safe value since the physical sizes and span lengths were such as to rule out any concern about pipe buckling under compressive loads.

Maximum Working Pressures

The second word of precaution pertains to the use of the maximum working pressures allowed by Division 2, Section 2 of the Code for Pressure Piping as a criterion for determining the allowable factor of safety in a span design. This code has been used throughout this paper as a reference and measure, but only to obtain illustrative comparisons which would apply to the combined stress analysis which has been presented. For a structure such as a pipeline span, where unusual conditions of external loadings or unexpected changes in the original piping installation might be expected more frequently than in the buried section of a pipeline, a design carried to the limiting factor of safety of this code might be considered ill-advised. In fact, this code has not been accepted in its entirety as the design standard for the 34-in. Topock-Milpitas gas main.

REFERENCES CITED

1. U. S. Department of the Interior, "Boulder Canyon Project, Final Reports, Part IV — Design and Construction, Bulletin 5, Penstocks and Outlet Pipes," p. 82.
2. Marin, Joseph, "Failure Theories of Materials Subjected to Combined Stresses," Transactions ASME, Volume 101 (1936), p. 1162.

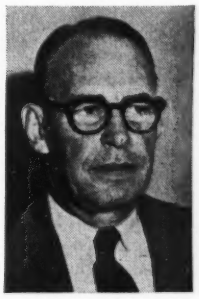
Acknowledgments

To J. B. Cooke and Simon Peters, both of the engineering department, Pacific Gas & Electric Co., San Francisco, for the original studies which developed this analysis of pipeline span stresses, and for their guidance in applying this analysis to the design of the 34-in. Topock-Milpitas gas transmission main.

PIPELINE PEOPLE

Northern Natural Gas Co.'s application to the Securities & Exchange Commission to acquire assets and surrender stock of its one remaining subsidiary, Peoples Natural Gas Co., a move aimed at simplifying the company's corporate structure, has been approved. Properties and business were transferred to Northern at the close of business on May 31, dissolving Peoples as a corporation. With the dissolution of its subsidiary, J. F. Merriam, president of the Omaha firm, has announced several promotions and changes in operating organization of Northern.

Ray Harrison



D. L. Sedgwick

Serving 89 communities in Nebraska, Kansas, Iowa, and Minnesota with gas supplied by Northern, Peoples will function as a retail organization as the Peoples Natural Gas Division of Northern. RAY HARRISON, formerly vice president and general manager, has been elected president. He was also elected vice president of Northern Natural. Management of Peoples will remain the same.

Northern's direct main line, rural and farm tap, gas field (other than well mouth), and all other retail sales have been transferred to Peoples. Northern's sales department, with DONALD L. SEDGWICK as director, has been renamed the wholesale marketing department and will concentrate entirely on town border sale of gas and all general aspects of the wholesale territorial market.

W. L. Shomaker

Earle Clark

Duties of Northern's vice president in charge of sales, W. LAWRENCE SHOMAKER, have been expanded to include public relations. He will work directly with vice president in charge of gas supplies, John Hanley, and president, J. F. Merriam, in matters of gas procurement. EARLE CLARK has been promoted to department head status as director of public relations, and will work with Mr. Shomaker in increasing public relations activities of the company.

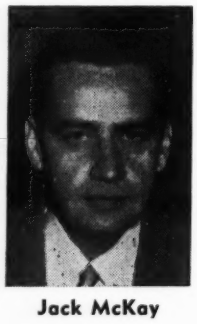
R. E. Daniel

ROBERT E. DANIEL, formerly assistant controller of Schlumberger Well Surveying Corp., Houston, has been named secretary and treasurer of Texas Eastern Production Corp., also of Houston. In other executive changes, JAMES W. BURKHART has become production manager, and HADEN J. UPCHURCH, manager of the land department. Mr. Burkhart was formerly general superintendent of Brown & Wheeler, oil operators, and an engineer for Baker Oil Tool Co. and Humble Oil & Refining Co. Mr. Upchurch was a district landman for the Cabot Carbon Co., Midland, Texas, and a titleman-lease buyer with Humble Oil.

Worthington Corp., Harrison, N.J., has announced the appointment of two new branch managers, PAUL J. FOLEY to the Kansas City office and WILLIAM M. FINE to Milwaukee. Mr. Foley has been with the company since 1937 as sales engineer in the Chicago office and later as manager of its Milwaukee branch. He succeeds W. R. KENNEDY, who will remain as consultant. Mr. Fine began his career with Worthington in 1939 as an estimating engineer in the Chicago office and in 1943 joined the sales force there.

After 43 years of continuous service, PAUL DISERENS, director of research and development of Worthington Corp., Harrison, N.J., is retiring. Mr. Diserens will continue with the company in a technical consulting capacity in engineering and research. Succeeding Mr. Diserens is RALPH M. WATSON. Mr. Watson's career with Worthington began in 1936 as an engineer in the refinery pumps section. In 1942 he was made chief engineer of the Centrifugal Pump Division, Harrison, N.J., and in 1945, assistant to the vice president in charge of engineering.

WILLIAM H. FRANKLIN, controller for Caterpillar Tractor Co., has been elected to a vice presidency of the firm. He has also been named secretary, replacing E. BORNSTEIN, who retired July 1 after 30 years with Caterpillar. A. N. WHITLOCK, assistant controller since 1948, becomes company controller.



Jack McKay

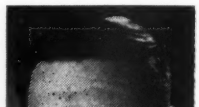
Appointment of JACK MCKAY as manager of the sales promotion department of the Fluor Corp., Los Angeles has been announced by the company. Mr. McKay, who joined the company in 1942, has been directly connected with the Fluor sales program for the past 8 years, serving as sales engineer, assistant to the director of sales, and assistant district sales manager of the company's Houston office.

Glass Fibers Inc. has named THOMAS R. SIMKINS manager of its Detroit branch where he will direct transportation sales. Mr. Simkins was formerly vice president and a director of the Glasfloss Corp., Hicksville, N.Y. He has also been affiliated with Owens-Corning Fiberglas Corp. and the Research Laboratory at Newark, Ohio, with time out for a special assignment to the Navy as consultant on shipboard power and lighting equipment.

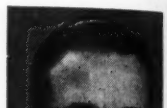
Estin Scearce

W. H. Miller

Promotion of four El Paso Natural Gas Co. men has been announced with the creation of the operations department. Advanced from positions as division superintendents, new operations managers are ESTIN SCEARCE, Permian division; W. H. MILLER, Southern division; R. W. HARRIS, San Juan division. Mr. Harris will also be in charge of the company's pipeline construction program. As chief engineer of the new department, J. F. EICHELMANN will be in charge of coordinating engineering matters with the engineering, operations and construction departments of the company. Headquarters of the department, created as a result of an expansion program planned to increase El Paso's natural gas deliveries more than 400 MMcf per day, will be at the company's home offices in El Paso.



R. W. Harris

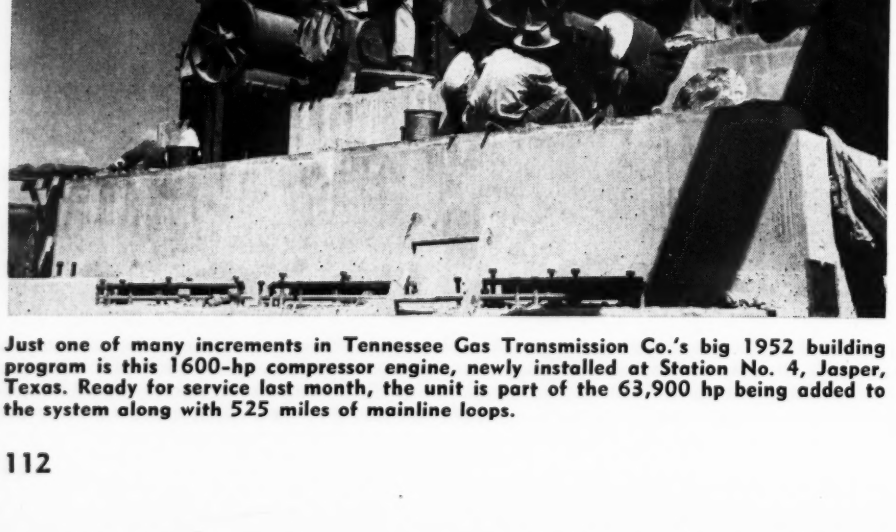


J. E. Eichelmann

ROY CARTER has been appointed manager of the Volute pump section, Worthington Corp., Harrison, N.J. In other appointments to newly-created managerial positions, L. H. GARNAR has become manager of the process pump section and I. J. KARASSIK is now manager of the multi-stage pump section. All three men were formerly assistants to the manager of the centrifugal pump division.

HOWARD BOYD, member of the Washington law firm of Hogan & Hartson, has accepted the position of vice president and assistant general counsel for El Paso Natural Gas Co. A year ago Mr. Boyd successfully represented the company in a suit to compel issuance of rights-of-way across government land in Arizona to complete a pipeline to California, and recently he participated in the steel seizure case before the Supreme Court..

Newly elected vice president of Associated Pipe Line Contractors Inc., Houston, is J. W. SHARMAN, named to fill the position left vacant when EARL ALLEN became president of the firm. Both men were associated formerly in the firm of Sharman & Allen, Mr. Sharman later becoming vice president of Latex Construction Corp.



Just one of many increments in Tennessee Gas Transmission Co.'s big 1952 building program is this 1600-hp compressor engine, newly installed at Station No. 4, Jasper, Texas. Ready for service last month, the unit is part of the 63,900 hp being added to the system along with 525 miles of mainline loops.

PIPELINE NEWS

Algonquin Wins Easements; Northeastern Alters Plans

Construction of natural gas pipelines to serve New England continued to plod along last month, Algonquin Gas Transmission Co. winning new easements battles while its rival, Northeastern, was appearing before FPC with an altered plan for serving Connecticut.

In White Plains, N. Y., a state supreme court granted Algonquin's motions to acquire rights-of-way across 13 properties in northern Westchester county. It was the second easement battle in which Westchester residents have been embroiled, the other having involved plans of Transcontinental Gas, which were recently canceled.

Algonquin also won clearances in the vicinity of Morristown, N. J., when verbal agreements were reached with property owners of four parcels of land which had previously been involved in litigation. The city's board of aldermen had earlier granted belated permission to cross town-owned property.

Northeastern, meanwhile, sought approval of an amendment to its certificate which would permit it to supply the newly-formed Connecticut Gas Co., Berlin, in place of Connecticut Light & Power, its parent. Conn Gas would build five short lines totaling 4.7 miles in length in order to transport the gas to Conn Light.

Other proposals brought forth in the same hearings involved changes in allocations of gas to Haverhill, Worcester, and Spencer, Mass., where mergers of several companies have required that allotments, formerly split, be consolidated.

El Paso Expansion Approved by Commission

The Federal Power Commission has authorized the El Paso Natural Gas Co. to build facilities to provide additional gas to customers in New Mexico, Arizona, and California, and supply a new wholesale customer which will serve markets in Nevada. El Paso Natural has acquired commitments on additional gas reserves developed in San Juan Basin since 1950 which made it reasonable to remove the annual limitation of 34 billion cu ft, which was imposed on the pipeline in 1950, the commission said.

Authorized facilities will provide (1) an additional 150 MMcf gas per day to Pacific Gas & Electric Co., San Francisco; (2) 150 MMcf additional to Southern California Gas Co. and Southern Counties Gas Co. of Calif., Los Angeles; (3) up to 20 MMcf daily to Nevada Natural Gas Pipe Line Co., Las Vegas; and (4) gas on an interruptible basis to Gallup, N.M., for use in a municipally owned electric power generating plant. Additional volumes will result in total delivery of 550 MMcf per day to PG&E and 555 MMcf to the Southern California companies.

The commission also authorized the three California companies and the Nevada company to construct facilities to transport the gas they will receive from El Paso, and authorized San Diego Gas & Electric Co. to build a new compressor station. A request by San Diego for an allocation of gas from Southern Counties was denied.

El Paso's expansion program will include 170 miles of mainline loop and about 153,000-hp in mainline and booster compressor stations on its existing transmission system, at an estimated cost of $108,680,164.

To increase its capacity by 150 MMcf, PG&E will build about 86 miles of loop line and add 19,540-hp to compressor facilities on its existing Topock-Milpitas pipeline. Cost of proposed facilities is $13,428,000.

The two southern California companies will add 20 miles of loop line and 13,520-hp of compressor units to their existing line extending from the Calif.-Ariz. boundary to Los Angeles, at an estimated cost of $5,053,686.

The San Diego company will build a new compressor station on the Rainbow end of its Rainbow-to-San Diego pipeline designed to provide 10 MMcf storage capacity. Estimated cost is $499,761.

The FPC order also approved a stipulation reserving a total of 150 billion cu ft of natural gas in San Juan Basin for sale to the Atomic Energy Commission during the period ending June 30, 1957.

Nevada Natural Certified To Serve Las Vegas Area

H. G. Laub

The Federal Power Commission last month issued a certificate of public convenience and necessity to the Nevada Natural Gas Pipe Line Co., to construct a 114-mile, 10¾-in. pipeline from Topock, Ariz. to Las Vegas, Nev. The 20 MMcf of natural gas per day transported in the line will be provided by El Paso Natural Gas Co.

The company will serve various industries of Henderson, Nev., and supply gas to the Las Vegas Co. for distribution to Las Vegas, North Las Vegas and Nellis gunnery school.

Harold G. Laub, elected president of the company last month, said he expects construction of the line, which will extend from Topock to Needles, Ariz., to Searchlight, Henderson and Las Vegas, Nev., to be completed in January 1953. Temporary offices for the company have been established at 7th and B Sts., Victorville, Calif.; telephone 5370.

Shenandoah Alters Plans

In an amended application to FPC, Shenandoah Gas Co., Lynchburg, Va., is asking approval to build, at a cost of $1,570,000, a 39-mile natural gas pipeline to supply gas to northern Virginia and northeastern West Virginia communities. An order directing Virginia Gas Transmission Corp. to supply the gas requirements for this project is also sought.

Under the present plan, the line would extend from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va. Gas would be sold at retail in Winchester, Middletown, Stephens City, and Clearbrook, Va., and in Bunker Hill and Inwood, W. Va. The fuel will be supplied at wholesale to Martinsburg Gas & Heating Co. for sale in that city. Shenandoah also plans to serve industrial customers adjacent to the pipeline.

Texas Eastern Gas Supply Allocated to 23 Customers

FPC allocation has been made of 84,094 Mcf of natural gas per day, a portion of 91,882 Mcf of unallocated and unsold delivery capacity which Texas Eastern Transmission Co., Shreveport, will have available upon completion of its expansion program now nearing the final stages. Twenty-three corporations and towns are scheduled to receive gas. Allocations were "reserved" for some, pending the filing of proper applications with the commission, while direct allocation was made in cases where no further commission action is required.

The remaining 7788 Mcf, which will be available at the same time, is to be reserved by Texas Eastern for emergencies. The company had sought to dispose of 107 MMcf per day but FPC said, if the allocations were authorized, Texas Eastern would be unable to meet future requirements of its firm customers.

The decision modified the examiner's decision which had proposed allocation of 28,081 Mcf per day to 20 corporations and towns, with the remainder of the 91,882 Mcf to be devoted to developing and operating the Oakford (Pa.) storage field.

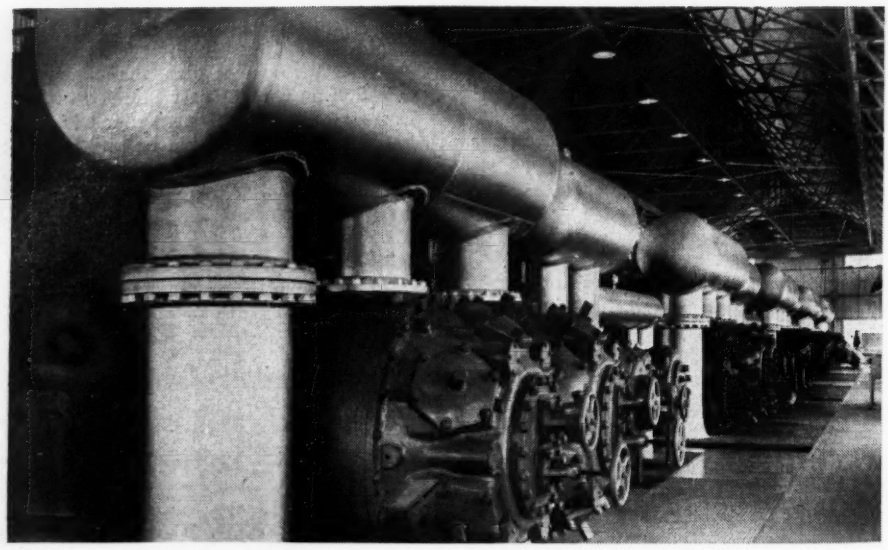
New York & Richmond Gas Co., Staten Island and Philadelphia (Pa.) Gas Works Co. were among the companies awarded allocations with volumes of 2220 Mcf and 4 MMcf respectively. Among the companies for which reservations were made are Ohio Valley Gas Co., Tell City, Ind., 4 MMcf; MidSouth Gas Co., Little Rock, 6513 Mcf; Public Service Electric & Gas Co., Newark, N. J., 45½ MMcf.

Sales to Pikes Peak Okayed

In a decision subject to review by the commission, FPC Examiner Francis L. Hall has authorized Colorado Interstate Gas Co., Colorado Springs, to construct facilities to supply natural gas to Pikes Peak Natural Gas Co. for resale in and near Eads, Colo., and to increase the supply to Citizens Utilities Co., in the vicinity of Fowler and Ordway.

Examiner Hall's decision denied Colorado Interstate's proposals to supply gas to Loran L. Laughlin for resale in Castle Rock and Fountain, and to Kansas-Colorado Utilities Inc. at points near Springfield and McClave, because he found the company does not have an adequate supply of gas to serve these two customers.

Application of Kansas-Colorado Utilities Inc., of Lamar, Colo., for approval of a short-term sale of surplus gas to Colorado Interstate was dismissed.



Five mammoth angle-type compressors with an aggregate rating of 12,500 hp compress the gas at the Ringwood plant to 750 psi for delivery to Oklahoma Natural.

Ringwood Plant Processes 50 MMcf Daily

THE Ringwood natural gasoline plant, a facility that will take 50 MMcf of natural gas and produce from it 80,000 gals. of liquid per day and more than 40 MMcf of residue gas for distribution through Oklahoma Natural Gas Co.'s pipeline network, was dedicated in June.

Located in the Ringwood oil field in Major county, Okla., the plant was a joint venture of the gas company and Warren Petroleum Corp. The latter company supervised construction and will operate all facilities.

Completion of the installation was the culmination of conservation efforts dating from early field development in 1945. Actual start of construction did not begin, however, until after the joint contract was signed last year.

Gathering operations necessitated the connection of 150 lease separators with the central compressing and processing plant through 3- to 36-in. lines. In the plant, the gas is compressed from atmospheric to 750 psi with five 2500-hp Clark angle gas engine-driven units. Gas processing facilities necessary to produce 32,000 gals. of natural gasoline, 24,000 gals. of butane, and 24,000 gals. of propane daily include fractionating, distillation, dehydration, treating, storage, and liquid loading equipment. Residue gas goes direct from the absorption unit through scrubbers and the dehydration unit to the gas line.

Some of the equipment features incorporating late industry developments include the extensive use of aerial coolers for engine lube oil and jacket water and for hydrocarbon condensing, the recovery of inherently available energy from a high pressure oil stream by use of a combination hydraulic power and pumping unit, the frequent use of pneumatic control for flow and temperature through activation from remotely located transmitter units, and the employing of hydrocarbon vapors inherently available in the system to strip the absorption oil instead of generating steam for this purpose.

A limited supply of water and costs of treating it necessitated certain equipment features to minimize net water consumption. These provisions include the elimination of a steam power plant by using gas engine and electric power, the use of aerial coolers for such services as gas engine jacket water and lube oil cooling and hydrocarbon condensing, and the use of direct fired rich oil furnaces for plant process heat. These furnaces have a total capacity of 36,000,000 Btu per hour.

The 36-in. line crossing Indian creek just west of the plant is reported to be the largest line in Oklahoma to be supported by a suspension bridge.

TET Compressors Approved

Texas Eastern Transmission Corp., Shreveport, has received Federal Power Commission approval to construct 12 compressor stations with a total of 102,540 hp on its 791-mile natural gas pipeline project. Now nearing completion, the project to increase the capacity of the company's system from Kosciusko, Miss. to Connellsville, Pa. by 465,700 Mcf per day to a total of 1,206,500 Mcf, was originally approved to include 13 compressor stations aggregating 96,400 hp.

The 12 station sites are located in Mississippi, Alabama, Tennessee, Kentucky, Ohio, Pennsylvania, and New Jersey. No increase in the transmission capacity of the system over that previously authorized was made in the commission ruling.

ArkLa Asks Capacity Boost

Arkansas-Louisiana Gas Co. has applied for FPC authority to build 6 miles of 12¾-in. natural gas pipeline in Hot Spring county and a 7500-hp compressor station on its "Line S" which extends from Waskom, Texas to Perla, Ark. Estimated cost of the proposed construction is $2,353,116.

The six-mile line would make available an additional 38 MMcf of gas per day to the Lake Catherine steam electric generating station of Arkansas Power & Light Co., bringing to 85 MMcf the total daily deliveries to that company. The compressor station would make greater volumes of gas available to consumers in central Arkansas by increasing average daily deliveries to the Perla regulating station by about 25 MMcf.

FPC, Northern Tangle on Definition of "Gathering"

In a unique case granting permission to construct additional facilities to Northern Natural Gas Co. of Nebraska, the FPC recently ruled that all the natural gas reserves of the company must be committed to the proposed system. Northern had previously announced its intention to sell or alienate its reserves if dissatisfied with the commission's rate-making policies.

The commission also held that Northern had erroneously classified an additional $11 million of proposed facilities as "gathering facilities" or as "not affecting system capacity" and ordered the company to file an application requesting authorization for their construction.

The FPC authorization is also conditioned to require Northern to supply natural gas to six additional communities. To do this, Northern will have to spend approximately $1.1 million constructing branch lines.

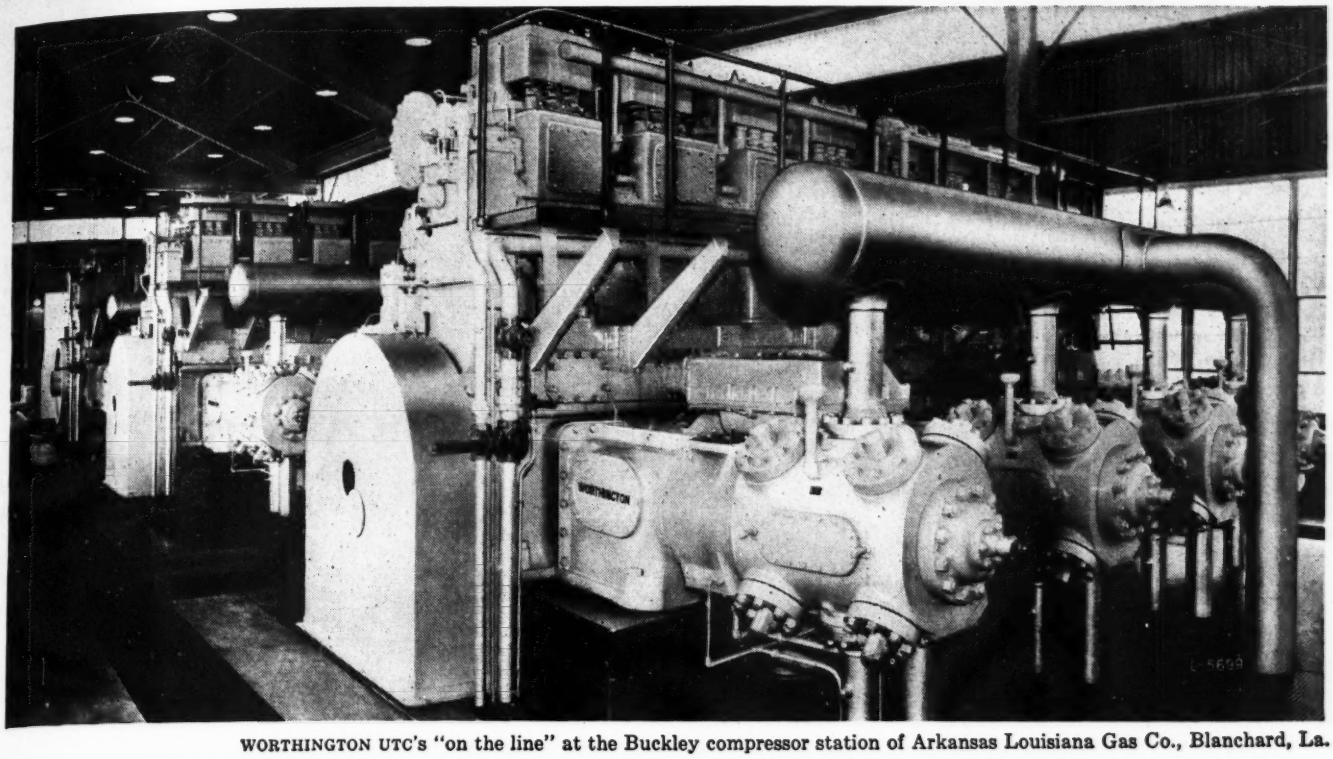
In a concurring statement, Commissioner Nelson Lee Smith recommended that the FPC modify its rate-making policies so as to encourage pipeline systems to find and develop more natural gas reserves. Commissioner Claude L. Draper disagreed with the majority decision, saying that he did not believe that the FPC has the authority to attach the conditions to the authorization as the Natural Gas Act specifically exempts "the production or gathering of natural gas" from FPC control.

Ohio Fuel Plans to Expand Underground Storage

Seeking approval for plans to expand its underground natural gas storage facilities an estimated 31,100 MMcf, the Ohio Fuel Gas Co., Columbus, has applied to the Federal Power Commission for permission to convert to storage six producing pools in north central Ohio. Estimated cost of the proposed construction is $4,880,000, funds to be provided by Columbia Gas System Inc., Ohio Fuel's parent.

The proposed project, which would enable Ohio Fuel to accept available gas during summer months to store for winter use, includes a 6000-hp storage compressor station; 78.2 miles of well and gathering lines; and 14.2 miles of line to connect storage areas with transmission facilities. Use of 75.3 miles of existing well and gathering lines would be discontinued under this plan.

Of the pools to be converted, one in Ashland and Richland counties would become part of the Weaver storage area. Two new storage areas would be developed by converting four pools in Holmes, Wayne and



WORTHINGTON UTC's "on the line" at the Buckley compressor station of Arkansas Louisiana Gas Co., Blanchard, La.

The Worthington count in the Shreveport area—

35 pipeline compressors to produce 53,000 bhp for five companies

Five leading gas-transmission companies have installed in the immediate Shreveport area alone a total of 35 Worthington UTC Engine-Compressor units with a combined output of 53,000 bhp.

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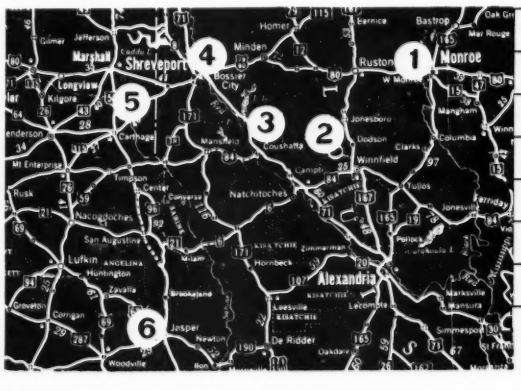

No.	Station	Total hp	Customer
1	Station 6, West Monroe, La.	12,800	Tennessee Gas Trans. Co.
2	Bienville Station	4,800	Southern Natural Gas Co.
3	Koran Station	4,000	United Gas Pipeline Co.
4	Buckley Station	7,000	Arkansas-Louisiana Gas Co.
5	Marshall Station	10,000	Texas-Illinois Natural Gas Pipeline Co.
6	Station 4, Jasper	14,400	Tennessee Gas Trans. Co.

COMPRESSOR STATIONS in operation or on order using Worthington UTC-Engine Compressors.

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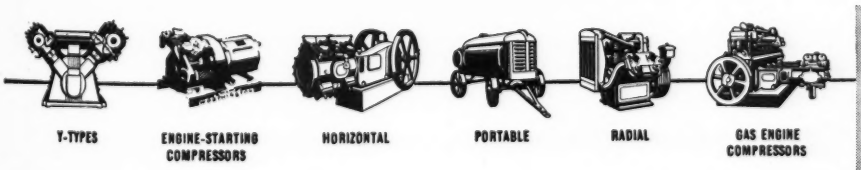

NO OTHER COMPRESSOR WILL OUTPERFORM A WORTHINGTON

WORTHINGTON

Engine Compressors

Ashland counties, and one pool in Guernsey and Coshocton counties. The potential capacity of the six pools would raise the company's total storage to approximately 143,350 MMcf.

New York State Natural Plans 95-Mile Expansion

Pending approval by the Federal Power Commission, the New York State Natural Gas Corp., Pittsburgh, plans to build about 95 miles of natural gas transmission line in Pennsylvania, which will enable it to secure gas from the recently discovered Driftwood gas field and other prospective areas along the line. Estimated cost of the proposed pipeline is $5,332,506.

The program includes immediate construction of 20 miles of 16-in. line from the Leidy compressor station in Clinton county extending southwesterly to a point near the Driftwood field in Cameron county, Pa. From the southern end of this line, the company plans to build a 75-mile, 20-in. line extending to a connection with its main dual line system in Armstrong county. This line would not be built until 1953. A 970-ft, 20-in. line, to be constructed upon approval, will connect the company's Sabinsville storage pool compressor station with existing transmission lines, permitting the compressor to be used to relay mainline gas.

Worthington Initiates New Engineer Training Program

With the signing of 52 engineers, Worthington Corp. has initiated a new placement program for recruiting and training college-graduated engineers. The program is under the direction of J. J. Thompson, manager of the newly-created personnel and training department which will absorb the functions of the former sales personnel division.

The 52 trainees will receive an intensive 12-month period of orientation and practical experience in all of the company's activities. The first six months will be devoted to general background in sales, manufacturing, accounting, purchasing, and engineering as the trainees are rotated on a planned schedule among the company's four plants. During the second six months, assignments will be made to specific jobs at one of the plants, a district sales office, or in a headquarters department.

Boiler Fuel Sales Approved

Final approval has been granted by the Federal Power Commission for Transcontinental Gas Pipe Line Corp., Houston, to deliver on an interruptible basis, a maximum of 30 MMcf of natural gas per day to Duke Power Co. for use as boiler fuel in its Lee Electric Generating Plant near Williamston, S.C.

The decision filed by Presiding Examiner Marvin Farrington in April was modified, however, to include the condition that service to Duke shall be subordinate to the requirements of Transco's direct and indirect customers for storage purposes. The commission noted that Duke is the company's only potential customer in that particular market area which can take the proposed volumes of gas on short notice and for a limited period of time.

Radio Network Aids Patrol of PG&E's Super Inch Line

A five-station short-wave radio network, which controls 40 radio-equipped field vehicles, is now in operation over Pacific Gas & Electric Co.'s 500-mile "Super Inch" natural gas line from Topock, Ariz. to Milpitas, Calif.

"This is another measure to insure against interruption of deliveries on the Super Inch," Fred E. Wilson, PG&E field superintendent, explained. "The radio system enables us to make immediate contact with field crews patrolling the line and get them quickly to any point where they may be needed."

Field crews regularly patrol the line, inspect it for possible breaks, and carry out routine maintenance work. The radio network plays an important role in this trouble-shooting. The five stations are situated at Milpitas, Hollister, and at three compressor plants—Kettleman, Hinkley and Topock.

Underground Storage Sites Tested by Northern Natural

Exploratory drilling to depths of about 900 feet, the first step in tests to determine whether natural gas can be stored underground in southern Minnesota, were scheduled by Northern Natural Gas Co., Omaha, to begin the first of last month. Exact sites had not been selected, but they were expected to be in LeSeuer and Rice counties.

If such storage in Minnesota is possible, it will permit Northern to deposit gas in the storage field during warm months when the supply exceeds the amount used. John Hanley, vice president in charge of gas supply, said this will enable the company to supply natural gas to customers in the Twin Cities area who otherwise would have to wait until new pipeline facilities can be built. The storage would also enable the firm to meet peak winter demands at costs less than if additional facilities had to be built.

This is the first time underground storage has been attempted in this area.

Increase Fresno Service

Pacific Gas & Electric Co., San Francisco, has received FPC approval to construct 50 miles of pipeline to increase natural gas deliveries to the Fresno-Merced (Calif.) area. The additional facilities will enable PG&E to take additional gas into the system and will aid delivery of gas throughout the system.

The new facilities, estimated to cost $1,979,000, will include 20 miles of 16-in. line extending from Burrel to a point near Easton in Fresno county; 15 miles of 20-in. line, also in Fresno county, from Helm to the company's Topock-Milpitas line; and 15.5 miles of 12¾-in. line to parallel the existing Madera-Livingston line in Madera county.

City Gas Case Reopened

FPC has reinstated proceedings involving delivery to City Gas Co. of Phillipsburg, N. J. of 1700 Mcf natural gas per day, made available by commission order in February, from Tennessee Eastern Transmission Co., Shreveport.

Applications had been filed by companies involved, proposing that Texas Eastern deliver the gas to Manufacturers Light & Heat Co., Pittsburgh, who would in turn deliver it to City Gas through a six-mile line to be built by Penn-Jersey Pipe Line Co., Easton, Pa. Allentown-Bethlehem Gas Co. asked to abandon facilities through which it presently delivers gas to City Gas Co. Dismissal was based on a technical matter involving Penn-Jersey, subsequently clarified.

Texas Eastern Drilling New Offshore Well in Gulf

Texas Eastern Production Corp. has awarded a drilling contract to the Salt Dome Production Co. of Houston for a new offshore well approximately 20 miles southwest of Galveston and 7½ miles off the coast of Galveston Island in the Gulf of Mexico. Drilling was scheduled to begin last month.

Texas Eastern's president, H. A. Hemphill, said the well, projected to a vertical depth of about 6000 ft, will be drilled as a directional hole to the southeast in an effort to define more definitely the location and extent of the natural gas reserves underlying the company's 11,070-acre offshore block.

It is hoped this well will prove natural gas reserves large enough and with potential deliverability sufficient to justify the construction of an offshore pipeline to market the gas. Two previous wells have been drilled in this location, one a vertical hole capable of substantial gas production below 5900 ft and the other a directional dry hole drilled to the northwest.

FPC Examiner Okays Gas To Atomic Energy Plant

The Federal Power Commission has authorized the Colorado-Wyoming Gas Co., Denver, to construct additional natural gas pipeline facilities and to serve the Atomic Energy Commission's plant now under construction at Rocky Flats, Colo.

New facilities will include a lateral line and meter station to supply natural gas at wholesale to Milliken, Colo.; 8000 ft of 8-in. line to augment service to the Fort Warren-Cheyenne, Wyo. area; and replacement of 2 miles of 4-in. pipe with 8-in. on its Golden, Colo. lateral. Total cost of the construction is estimated at $108,055.

The commission also authorized Colorado-Wyoming to continue to serve several direct sale industrial customers for which FPC approval had not been secured previously. The examiner denied a proposal by the company to sell natural gas to The California Co. near Nunn, Colo. for exploratory drilling purposes.

Purchase Approval Asked

In a recent application to the Federal Power Commission, Mississippi Valley Gas Co., Jackson, is seeking authority to acquire —for $3.3 million—and operate two pipeline systems and related storage facilities now operated by Mississippi Gas Co., a subsidiary of Southern Natural Gas Co.

The facilities involved include a system

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in Clay, Monroe, Chickasaw, and Lee counties with storage in Monroe county, and a system in Winston, Choctaw, Webster, Calhoun, Oktibbeha, and Chickasaw counties, now under lease from North Central Natural Gas District. While Mississippi Valley proposes to acquire all of the Mississippi Gas properties, it was joined by Mississippi Gas in requesting approval of the transaction to the extent that FPC has jurisdiction.

Asks Okay of S.C. Pipeline

South Carolina Natural Gas Co., a new corporation of Columbia, S.C., is seeking FPC authorization to build a 160-mile natural gas transmission system to carry 30 MMcf per day of natural gas to South Carolina Electric & Gas Co., also of Columbia, for resale in Columbia, Charleston, and Summerville, S.C. The company has entered into an agreement with Southern Natural Gas Co., Birmingham, to supply its natural gas requirements.

The proposed system would connect with Southern Natural's facilities at a point near Aiken, S.C. and extend southeasterly through Orangeburg, Dorchester, Charleston, and Berkeley counties to Charleston. A branch line would run northeasterly from Aiken county through Lexington and Richland counties to Columbia. Estimated cost of the project is $5,630,000.

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Conservation Pact Hinted By Mexican Gas Producer

Sr. Antonio Bermudez, director of Petroleos Mexicanos, Mexico City, has been putting out feelers to see whether the U. S. government and the oil and gas industry are interested in establishing an international petroleum and gas pact, ostensibly for conservation reasons.

The official of the large south-of-the-border corporation was quoted recently as saying that since "we both have certain gas and oil reserves at our disposal, part in the United States and the remainder in Mexico, it would be mutually advantageous to apply to Mexican wells the same conservation methods used in the United States."

Petroleos Mexicanos is currently involved in the Texas-Ohio Gas Co. (Houston) case pending before FPC. Hearings were recently held on FPC staff motion to dismiss the project, which envisioned the construction of a 1439-mile line from the Texas border to West Virginia. Gas for the line was to be provided by Pemex.

Pacific Northwest Buying Likely San Juan Property

As FPC hearings continued last month in the consolidated dockets of the several companies seeking permission to export gas from Canada to the U. S. Pacific Northwest, closer attention was being given to developments in the San Juan basin—the "four corners" area of New Mexico, Arizona, Colorado, and Utah.

There Pacific Northwest Pipeline Corp., the Ray Fish-backed concern proposing to pipe gas from San Juan to Seattle and environs, was reported to be "assembling" large blocks of semi-proven acreage—a total of about 440,000 acres, with estimated reserves of 4 trillion cu ft. Sometime this month the company is expected to press its application before FPC.

In the Washington hearings, one of the first steps was the severance of Tennessee Gas Transmission Co.'s proposal to export gas at Niagara Falls through a connection with Niagara Gas Transmission Ltd. The move was made at the behest of the two companies directly involved, as well as Northwest Natural Gas Co., one of the entrants in the Pacific Northwest race.

Line Increase Approved

United Natural Gas Co., Oil City, Pa. has received FPC approval to construct pipeline facilities to increase the delivery capacity and flexibility of operation of its natural gas transmission system in and near Oil City, Franklin, Meadville, Pin Oak, Titusville, Pittsfield, Youngsville, and Irvine, Pa.

The company's construction program includes 15.1 miles in Venango county from its Van compressor station to a connection with existing Oil City-Titusville line to replace a 6.5-mile portion of 8-in. line; about 12.4 miles of 6-in. line in Warren county from a point north of Tidioute to a connection with United's Youngsville-Irvine line, replacing a 2.7-mile, 3-in. line and permitting removal of a 5-mile line.

Pipeline Newsnotes

FPC has granted authority to Montana-Dakota Utilities Co., Minneapolis, to construct a 2640-hp compressor station in Butte county, S. D. to provide more natural gas to the Rapid City-Sturgis (Black Hills) area. Estimated cost of the new compressor station is $752,927. The new compressor installation will enable the company to boost its present 23-MMcf capacity to meet its estimated 1956-1957 peak-day requirements of 31,220 Mcf.

The Saskatchewan Department of Natural Resources has announced a very encouraging show of natural gas as the result of a test made at 1140 ft in exploratory well Whitesand No. 1. The well, being drilled by Consolidated Allenbee & Associates in the Viking formation about 70 miles west of the Manitoba boundary and 45 miles northwest of Yorkton, is the first to show natural gas in eastern Saskatchewan.

H. A. Rhodes, superintendent of communications for Transcontinental Gas Pipe Line Corp., Houston, was reelected chairman of the National Petroleum Radio Frequency Coordinating Assn. at the annual meeting of the group June 11 in the Mayflower Hotel, Washington, D.C.

To expedite deliveries of its industrial coating products to western and mid-western customers, Royston Laboratories Inc., Blawnox, Pa. has acquired additional warehouse facilities in Tulsa, Okla. Among the products to be stored in Tulsa are Roskote cold-applied pipe mastic, Royston Glas-Wrap, Roskote quick-drying shop coats and Roylac aluminum. Warehousing will be continued at Blawnox and Springdale, Pa.

"The Vertical Turbine Pump Story" is the title of a stripfilm, synchronized to a 20-minute narration, just released by Worthington Corp., Harrison, N.J. The film containing 165 color-frames of drawings, art work and photographs, visually clarifies and emphasizes characteristics of vertical turbine pumps which make them suitable to various applications in addition to the already popular use in deep wells.

Arkansas Western Gas Co., Fayetteville, Ark. has applied for Arkansas Public Service Commission authority to build a natural gas distribution system in West Fork and 10 miles of transmission line in Washington county, a distribution system in Centerton, and 5 miles of transmission line in Benton county. The Washington county line will eliminate the drain on the Fayetteville system by an extension to Greenville and improve service to both towns. The new distribution systems will provide service to 380 customers.

Announcement has been made by M. E. "Panama" Shiflett and M. S. Williams of the formation of a partnership under the name of Panama-Williams Co. The new organization, with offices in the Melrose Building, Houston, will engage in general pipeline construction. Mr. Williams was formerly vice president of Anderson Brothers Corp. Mr. Shiflett was general superintendent of the same company.

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PROGRESS REPORTS

Planned

ARKANSAS-LOUISIANA GAS CO., Shreveport. Docket G-1979 for 6 miles of 12¾-in. line in Hot Spring county and a 7500-hp compressor station on the company's "Line S" between Waskom, Texas and Perla, Ark.

ARKANSAS-MISSOURI POWER CO., Blytheville. Docket G-1900 for a line from Campbell, Mo. to Blytheville, Ark., and a line from a point just west of the St. Francis river in Clay county, Ark. to Rector, Ark. The total of 140 miles of pipeline is to serve 13 communities in Arkansas and 5 in Missouri.

ASSOCIATED NATURAL GAS CO., Tulsa. Docket G-1929 for 32 miles of line for service to Jackson, Portageville, Gideon, Morley, Spoonerville, and Bernie, Mo.

ATLANTIC SEABOARD CORP., Charleston. Docket G-1850 for two new compressor stations aggregating 7640 hp, with 3080 hp addition to be installed in existing station, all in West Virginia.

CAROLINA NATURAL GAS CORP., Charlotte, N. C. Docket G-1956 for 40 miles of line to connect with Transco line near Kings Mountain, N. C., extending to Rock Hill, S. C., with laterals to four South Carolina points.

CENTRAL KENTUCKY NATURAL GAS CO., Charleston. Docket G-1905 for 8.8 miles of 20-in. pipeline to parallel an existing section from North Means, Ky. to Cincinnati.

CENTRAL WEST UTILITY CO., Kansas City. Docket G-1682, four alternate plans to serve Clay county, Mo.

CONNECTICUT GAS CO., Berlin. Docket G-1954 for 5 short pipelines, totaling about 4.7 miles, to extend from Connecticut Light & Power gas plants—2 to Northeastern's system from plants at Winsted and Norwalk; 3 to Algonquin Gas Transmission Co. from plants at Waterbury, Willimantic and Putnam, Conn.

EAST TENNESSEE NATURAL GAS CO., Knoxville. Docket G-1336 for a 100-mile, 16-in. line from near Knoxville to Kingsport, Tenn. with appurtenant equipment.

GLACIER GAS CO., Butte, Mont. Dockets G-1816, G-1817, G-1818 for 285 miles of 20-in. from northeast of Kalispell, Mont. to Spokane, Wash.; 91 miles of 8⅝-in. from Spokane to Lewiston, Idaho; 120 miles of 16-in. from Spokane to Hanford, Wash.; 130 miles of 12¾-in. from Spokane to south of Trail, B. C.

HOME GAS CO., Pittsburgh. Docket G-1893 for 32.5 miles of line in Chemung and Broom counties, N. Y.

INDIANA GAS & WATER CO. INC., Indianapolis. Dockets G-1813 and G-1937, for 19 miles of 8-in. paralleling Panhandle Eastern Pipe Line's lateral between Panhandle mainline and Crawfordsville; 13 miles of 6-in. paralleling Panhandle lateral from its mainline to Lebanon; both lines to be operated by Panhandle.

KANSAS NEBRASKA NATURAL GAS CO., Hastings. Docket G-1857. To build 179 miles of line in Kansas and Nebraska and rearrange certain compressors, stub lines and metering stations to serve new mainline industrial customers.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh, Pa. Docket G-1893 for 40 miles of pipeline in Allegheny, Washington, and Beaver counties, Pa., and Belmont, Jefferson, and Columbiana counties, Ohio.

MIDSOUTH GAS CO., Little Rock, Ark. Dockets G-1445 and G-1680 for 240 miles of line in Greene, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, Poinsett, and Cross counties, Ark.

MISSISSIPPI RIVER FUEL CORP., St. Louis. Docket G-1932 for construction of 17 compressor units, totaling 13,385 hp, in 7 existing stations in Arkansas and Missouri, and one new station in Missouri.

MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. Docket G-1509 for 25 miles of 6-in. from Moberly to Macon, Mo.

MORGANFIELD NATURAL GAS CO., Morganfield, Ky. Docket G-1935 for a 31-mile, 4- and 6-in. line lateral to proposed Texas Gas Transmission Corp. line, to serve 6 Kentucky communities.

NATURAL GAS STORAGE CO. OF ILLINOIS, Chicago. To build facilities to develop an underground storage area 15 miles from Kankakee, Ill.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1980 for a 20-mile, 16-in. line from Leidy compressor station, Clinton county to Driftwood gas field, Cameron county; 75-mile, 20-in. line from southern end of Driftwood field line to main dual line in Armstrong county, Pa.; 970-ft, 20-in. line connecting Sabinsville compressor station to transmission line, Tioga county; 75-mile line to be constructed in 1953; remainder upon approval.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1918 for 400 miles of 24-in. pipe from the United States-Canadian border to a point near Minneapolis and two compressor stations with 5280 hp each.

NORTHWEST NATURAL GAS CO., New York. Docket G-996 for 645 miles of 18-, 20-, 22-, and 24-in. line in Washington, Idaho and Oregon, together with laterals and four compressor stations aggregating 24,750 hp.

OHIO FUEL GAS CO., Columbus. Docket G-1911 for 33 miles of 20-in. to replace 42 miles of existing 8⅝- and 10¾-in. pipe in Crawford, Wyandot, and Seneca counties, Ohio.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Dockets G-1429, G-1908, and G-1909 for 828 miles of line to serve Portland, Ore. and Spokane, Seattle, and Tacoma, Wash.

PERMIAN BASIN PIPELINE CO., Chicago. Docket G-1928 for a 384-mile line from Upton county, Texas, through Lea county, N. M., north to Roosevelt county, N. M., and northeast to Carson county, Texas, connecting with facilities of Northern Natural Gas Co.

PIEDMONT GAS CO. INC., Hickory, N. C. Docket G-1617 for 28 miles 6-in. line.

ROCKLAND LIGHT & POWER CO., Nyack, N. Y. Docket G-1728 for 22 miles transmission line between Orangetown and Tomkins Cove, N. Y. Postponed indefinitely.

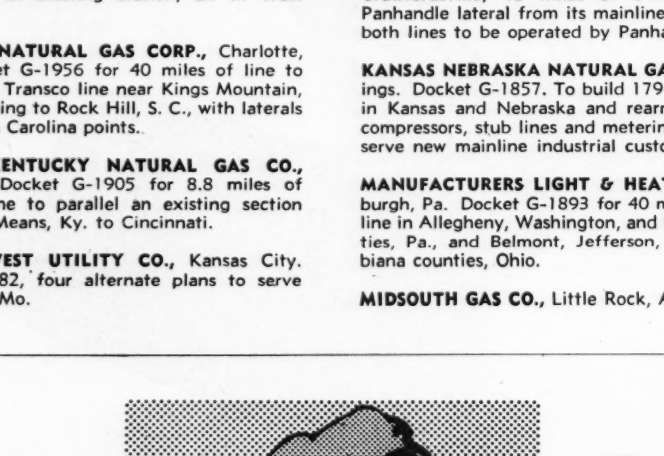
SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va.

SOUTH GEORGIA NATURAL GAS CO., Birmingham. Docket G-1915 for a 339-mile line to serve communities in southwest Georgia and northern Florida. Main trunk would connect with system of Southern Natural Gas Co. in Lee county, Ala., and extend to Albany, Ga., with a branch to Tallahassee, Fla.

SOUTH CAROLINA NATURAL GAS CO., Columbia, S. C. Docket G-1961 for a 160-mile pipeline in Aiken, Lexington, Richland, Orangeburg, Dorchester, Charleston, and Berkeley counties, S. C.

SOUTHERN NATURAL GAS CO., Birmingham. Dockets G-1676 and G-1907 for 1254.7 miles of various size pipelines and seven compressor stations totaling 33,300 hp in Alabama, Georgia, Mississippi, Louisiana, and South Carolina.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1993 for a 3300-hp compressor sta-



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tion to be located on company's 14-in. supply line from Logansport (La.) gas field.

TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-1921 and G-1922 for a presidential permit to construct and operate facilities at the International Boundary north of Niagara Falls and for FPC certificate for 45 miles of 20-in. from Buffalo to Niagara; 107 miles of 26- and 30-in. loop on mainline; six new compressor stations with 80,500 hp; 51,500 hp in old stations; 50 miles of laterals; aerial suspension bridge over Niagara river.

TENNESSEE GAS TRANSMISSION CO., Houston. Docket G-1930 for a 2640-hp compressor station in Carthage field, Panola county, Texas.

TEXAS EASTERN TRANSMISSION CO., Shreveport. Docket G-1947 for 315 miles of 24-in. line from a point in Lavaca county, Texas to Castor, La., with a 5500-hp compressor station in Shelby county, Texas.

TEXAS GAS TRANSMISSION CORP., Owensboro. Docket G-1847 for 407 miles 26-in. loop line on sections of existing line between Bastrop, La. and Hardinsburg, Ky., together with installation of 14,620 hp.

TEXAS-OHIO GAS CO., Houston. Docket G-1810 for 1439 miles of 30-in. from Hildalgo county, Texas, through Arkansas, Mississippi, Tennessee, Kentucky, Ohio, and terminating near Spencer, W. Va., including 14 compressor stations totaling 135,000 hp.

TRANS-CANADA PIPE LINES LTD., for 2200-mile line from Alberta to major cities as far east as Montreal.

UNITED FUEL GAS CO., Charleston, W. Va. Docket G-1952 for 21.5 miles of gas pipeline, one 880-hp compressor station and addition of 3960 hp to an existing station.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1879 for compressor stations at Napoleonville and Jackson, Miss., for 13,280 total hp; and an addition of 8000 hp at authorized stations near Montpelier, La., and in Walthall county, Miss.

UNITED GAS PIPE LINE CO., Shreveport. Docket G-1951 for 31 miles of 20-in. line from an offshore gas field in the Gulf of Mexico to connect with line under construction in Terrebonne Parish, La.

UTAH NATURAL GAS CO., Salt Lake City. To build a 360-mile line from the San Juan basin to Salt Lake City. A secondary line would run from Last Chance field (Wayne county, Utah) through Sevier and Sanpete counties.

WESTCOAST TRANSMISSION CO. INC., Wilmington, Del., 349 miles, including 277 miles from Sumas, Wash. to Portland, Ore. with short branches to a number of cities in the two states, and 72 miles of laterals and 13 measuring stations.

WESTERN SLOPE GAS CO., Denver, 49 miles of main transmission line and 30 miles of gathering lines to bring natural gas to Grand Junction from the Douglas Creek field, Rio Blanco county; Germesa field, Garfield county; and Highline Canal and Asbury Creek fields in Mesa county.

WILCOX TREND GATHERING SYSTEM INC., Dallas. Docket G-1959 for 217 miles of line and one 2200-hp compressor station in Lavaca, Jackson, Dewitt, Victoria, Bee, Goliad, Karnes, Live Oak, McMullen, and Duval counties, Texas.

Under Way

ALGONQUIN GAS TRANSMISSION CO., Boston. Facilities to serve designated companies in Massachusetts, Rhode Island, Connecticut, and New Jersey. Includes 253 miles of main line and 279 miles of laterals. Associated Pipeline Contractors Inc. at work on 200 miles in Massachusetts, Connecticut, and Rhode Island; J. F. Fitzgerald Construction Co., Boston, 10 miles near Waltham, Mass. To complete in October.

LAKE SHORE PIPE LINE CO., Cleveland, Ohio, 45-mile, 10¾-in. line from Meadville, Pa. to

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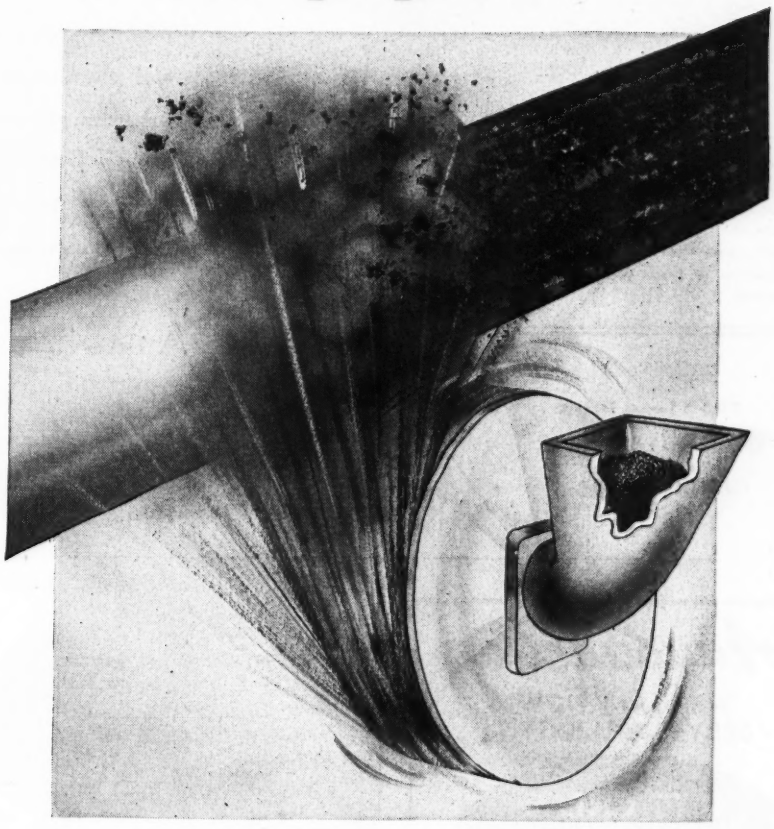

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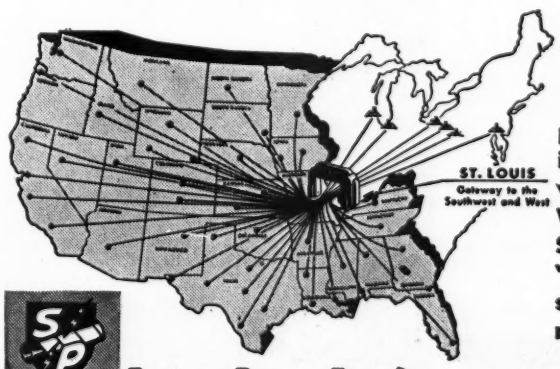

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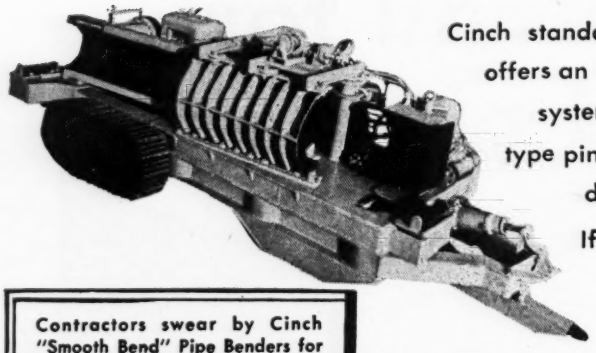

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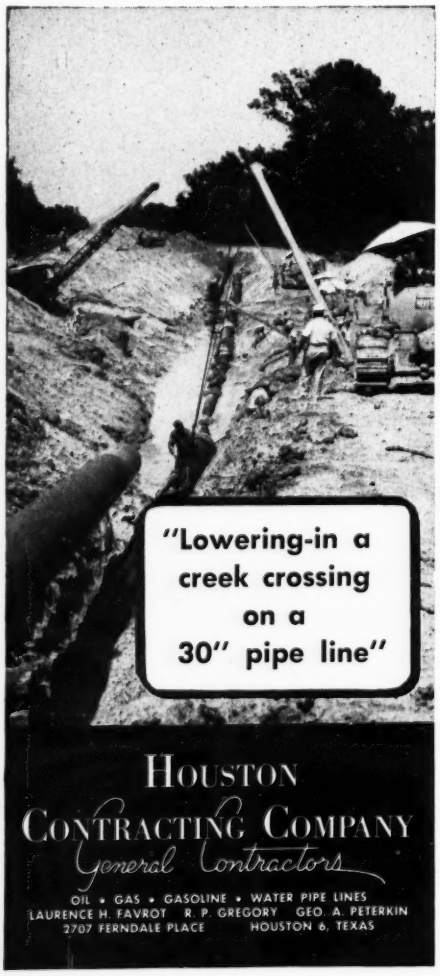

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Ashtabula, Ohio. Contractor has right-of-way nearly cleared, 50% of road and railroad crossings bored and cased. Pipe delayed by strike.

NATURAL GAS PIPELINE CO. OF AMERICA, Chicago, has Midwestern Constructors at work on station alterations at 107, Emerson, Iowa, and 108, Truro, Iowa; 17% complete.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1824 for 104.7 miles of line in Pennsylvania and New York and installation of an additional 2420 hp at two existing compressor stations in Westmoreland and Tioga counties, Pa. Williams-Austin Co. is at work on 52 miles of 16-in. line from Utica to Amsterdam, N. Y.; 20 miles of 20-in. from Cayuta Gate to Ithaca, N. Y.; 12.3 miles of 20-in. line in Beaver and Butler counties complete and in operation.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Pipe Line Construction & Drilling Co. for 23½ miles of 16- and 20-in. line from Preston station near Waynesburg, Pa. to Colvin Gate, Washington county, Pa.

NIAGARA MOHAWK POWER CORP., Syracuse, to H. L. Gentry, for 20 miles of 10-in. through 24-in. line in the vicinity of North Syracuse. Work under way June 9.

NORTHEASTERN GAS TRANSMISSION CO., Springfield, Mass. has completed about half of lines under construction to serve New England, remainder as follows: 65 miles 16-in. from Greenwich, Conn. to Springfield, Mass.; 23 miles 4-in. from Granville, Mass. to Torrington, Conn.; 25 miles 8- and 6-in. from Lowell, Mass. to Concord, N. H.; 17 miles 4-in. from Salem to Gloucester, Mass.; 12 miles 4- and 3-in. to meter stations. Anticipate completion by September 15. New Britain, Conn. was scheduled to receive gas by mid-July.

NORTHERN NATURAL GAS CO., Omaha, has Reese Brothers Construction Co. at work on 140 miles of gathering lines in Kansas and Oklahoma, 35 miles completed, remainder to be completed by January 1953.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1709 for a 44-mile 8⅝-in. line in Monterey county, Calif. Scheduled for completion Aug. 15, 1952.

TENNESSEE GAS TRANSMISSION CO., Houston. 521 miles of looping along present system; 420 miles, 30-in., Texas, Louisiana, Arkansas, Mississippi, Tennessee, and Kentucky, and 101 miles 26-in., Kentucky and Ohio. Houston Contracting, 45 miles of 30-in., Eros, La. to Coldwater, La. Oklahoma Contracting Co. is building three sections in Texas: 20 miles, Refugio to northeast; 50 miles, East Bernard to Cypress; 47 miles, Cleveland to Woodville. Anderson Brothers: 33 miles from Greenville, Miss. to near Drew; 37 miles from Holly Springs, Miss. to near Mississippi-Tennessee line; 37 miles from Selmer, Tenn. to Parsons. Western Pipeline Constructors: 32 miles, White Bluff, Tenn. to near Springfield; 27 miles, Greensburg to Lebanon, Ky. H. C. Price: 59 miles from Oak Hill to Glouster, Ohio; 24 miles from Uhrichsville to Carrollton, Ohio. Station enlargements at Agua Dulce, Victoria, East Bernard, and Jasper, Texas; Natchitoches and West Monroe, La.; Greenville and Batesville, Miss.; Lobelville and Portland, Tenn.; Campbellsville, Greenup, Winchester, Ky.; Albany and Cambridge, Ohio. New stations: Carrollton, Ohio; Mercer, Pa.; West Winfield and Nassau, N. Y.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Line as far north as Ohio river now in operation. Anderson Bros. at work on 217 miles of 30-in. line from Ohio river crossing near Wheelersburg, Ohio, to Station 21 near Connellsville, Pa., expected to be completed this summer.

UNITED GAS PIPE LINE CO., Shreveport. Gulf Southern Contractors at work on 1017 miles of 6- to 30-in. line in Texas, Louisiana, and Mississippi and offshore in the Gulf of Mexico; Brown and Root at work on 9 compressor stations and 10 dehydration plants in the above states; Pittsburgh-Des Moines Steel Co. at work on suspension crossings over Brazos and Red rivers; Massey Pipe Line Construction Co. is laying 16 miles